What are the possibilities of the sonic laboratory?

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Abstract

This research is informed by my work as a curator working with sonic arts and DIY technology. It considers the historical and contemporary concepts and practices of the sonic laboratory, investigating the origins of laboratory terminology and examining various typologies. From there, it closely considers artists' practices in laboratory models of academic and artistic labs dedicated to the research and development of sound. Finally, it explores the potential of sonic laboratories through planetary listening and field recording to challenge the conventional and hegemonic practices of specific laboratories and identify the sonic laboratory's transformative potential.

For this critical investigation of the laboratory, I draw on Bruno Latour's text, *Laboratory Life: The Construction of Scientific Facts*, which states, "Scientific activity is not 'about nature,' it is a fierce fight to construct reality. The laboratory is the workplace and the set of productive forces, which makes construction possible" (Latour and Woolgar, 1986, p.243). This transformative potential of the laboratory motivates my research. It reinforces my interest as a curator in the relationships between sound, art, science, and technology in different interdisciplinary fields, as viewed through the laboratory's focus.

The research reveals that most conventional laboratories perpetuate the "military-industrial complex" (Beck and Bishop, 2020, p.1). This hegemonic structure becomes problematic because it derives from colonial practices in which models that exclude otherness predominate.

In response, my research suggests that sonic laboratories can offer an alternative to those hegemonically constituted laboratories. Therefore, this thesis explores the potential to open possibilities within laboratory conventions from sonic laboratory practices. To this end, my overview of different types of sonic laboratories (through sound artists in laboratory residences, academic labs, and field recording labs) tries to chart and arrive at an alternative, what I will call the hybrid lab, a lab that becomes multiple, complex, diverse, and inclusive. This hybrid laboratory challenges hegemonies, allowing the sonic laboratory's potential to develop in broader contexts of knowledge production.

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Thesis Introduction

This research is prompted and framed by my practice as a new media curator and my interest in sound art practices. Sound and technology have long interested me as part of my curatorial work. In studying technology through a previous postgraduate master's and my activity as a curator, I became interested in the laboratory as a place where science, sound, art, and technology can happen together and where, therefore, transformative and hybrid practices can gain traction.

When I started this research, I understood laboratories mainly in their scientific definition as places of possible nature modification where viruses, genes, etc., are directly manipulated. According to Bruno Latour, laboratories may also be places for social modelling: "laboratories are one of the few places where the very composition of the social context has been metamorphosed. It is not a small endeavour to transform society" (Latour, 1983, p.158). Following his identification of the laboratory as a composer of the social context, this research aims to produce an extensive survey of current laboratory practices and, from there, explore sonic laboratories as a possible typology with the potential to create new forms of laboratories and social questions, practices and contexts from sound.

Although present in many different contexts, sonic laboratories require more investigation. Sonic laboratories exist, for example, in academia, studios, and workshops. Thus, the thesis does not aim to introduce the sonic laboratory; instead, the research seeks to encounter sonic laboratory models to explore how working with sound can address existing issues in laboratory institutions, such as hegemony, lack of collaboration, and female and otherness under-representation.

The laboratory is a complex and broad concept, with many typologies influencing societies' knowledge processes. I explore sonic laboratories to understand their potential for challenging hegemonies, and I investigate their characteristics and analyse their transformative potential to apply sound art, field recording, and other sonic methods to discover new laboratory potential. The suggestion is that the relationship between the laboratory and sound art can reveal new insights into the sound art scene and artistic practices, too.

In the first instance, I develop a laboratory typologies survey. This survey assists in recognising the features and behaviours of laboratory types. Highlighting and contrasting their characteristics helps me identify the sonic laboratory's particularities and idiosyncrasies compared to conventional laboratories. During this survey, I encounter a problem that became central to this research. As this thesis will show, I identify conventional laboratories, placed within mainstream institutions that, as I suggest, have become hegemonic. In this

context, I define hegemony as a political and social behaviour derived from colonial practices in which the imposition of models that exclude otherness dominates. Edward Said captures this definition of hegemony and explains how Western cultural power constructs and maintains exclusionary models:

> It is hegemony—or rather the result of cultural hegemony at work—that gives Orientalism the durability and the strength I have been speaking about so far. Orientalism is never far from what Denys Hay has called the idea of Europe … the idea of European identity as a superior one in comparison with all the non-European peoples and cultures. In addition, the hegemony of European ideas about the Orient … reiterating European superiority over Oriental backwardness … Orientalism depends for its strategy on this flexible positional superiority … without ever losing … the relative upper hand (Said, 2000, p.12)

I also understand hegemony as the development and legitimacy of specific (social) models that impose standardised values and processes based, for example, on Eurocentric rationalism.

In response, I develop the hypothesis that there are what I call “hegemonic laboratories”. These laboratories, as I show, result from power practices within corporations, governments, and institutions, establishing specific ways of understanding our world and universalising its productive processes and cultural outcomes by imposing rules and knowledge schemes. One example, which I find during the survey work are industrial laboratories, or the MIT Media Lab and its activity “that helped contribute to a momentum of institutional alliances, geopolitical demands, total war mentality, and a shared belief in technological solutions to military/political problems that can be found in the technicity the university established with the government prior to World War II” (Beck and Bishop, 2020, p.53).

Through my thesis, I develop a criticism of these hegemonic laboratories based on Donna Haraway's notion of the “nature-culture” continuum. Haraway defines the divide between nature-culture as imposed by scientific objectivity and domination as an apparatus for social control, which entails exploitation and object rationalism. The model of scientific truth resulting from the imposition of techno-scientific structures (of which laboratories might be part) by developed capitalist countries represents models of extinction and extraction imposed on non-developed countries from Eurocentric regions, thereby perpetuating the politics of capitalism, colonialism, and patriarchy. In Haraway's words,

> Everything happens as if the solution lies in a surplus of engineering or scientific rationality. From a systemic perspective, the social world is presented too simply, objectified and quantified, ruled by causal laws, and therefore likely to interface and

> coordinate with natural sciences through input and output flows. How does situated cultural and social reality challenge the clarity and simplification of the systemic approach? How does it open other ways of doing, acting, and thinking in the Anthropocene? How does it offer an alternative view of the present, for which the very term Anthropocene seems inadequate? (Haraway, 2015)

In response to this quote, I propose adopting situated practices to improve laboratory behaviour and development in my thesis. The suggestion is that situated practices can connect to the diversity of interspecies in the context of planetary thinking. This involves recognising the varied expressions of cultures, bodies, species, and discourses while applying anti-colonial thinking against dominant methodologies that objectify knowledge and values.

The definition and identification of hegemonic laboratories are made following Bruno Latour's definition of laboratories. According to Latour, laboratories have been created under systematic processes that make their outcomes incontrovertible, indisputable, irreversible, and irresistible because of their attributed "demiurgic powers" (Latour, 1987, p.167). However, as I will show, there are also “counter-laboratories” (Latour, 1987, p.79). Counter-laboratories were born from the dissenters' necessity to "reject the laboratory results" (ibid.). Hackerspaces, some biolabs that employ DIY methods, and fablabs exemplify counter-laboratories aligned with Latour's concept. Through case studies, I demonstrate how they operate beyond conventional scientific institutions, aiming to improve access to knowledge, promote collaboration, and challenge established research paradigms. Through the thesis, I aim to investigate whether the sonic laboratory represents such an alternative, a counter-laboratory able to critique and oppose those identified as hegemonic laboratories.

This research aims to produce an extensive survey of current laboratory practices and, from there, to explore sonic laboratories as a possible typology with the potential to create new forms of laboratories and social questions, practices, and contexts through sound. Although present in many contexts, sonic laboratories require more investigation. The thesis research question enquires about the possibilities of the sonic laboratory. I want to make clear that sonic labs already exist in the form of artists' residences and academic labs, for example. But their particularities may make them an alternative to institutional modes and a situated, inclusive, diverse, and plural place that, specifically, applies sonic practices of listening, sonic technologies, research, and other related methods. A sonic lab is already a laboratory that works with sonic-centred components, and these will also be identified throughout the thesis, which is developed through five chapters.

Chapter 1 presents a literature review that provides an overview of laboratory types, from antecedents to contemporary examples, and includes a historical definition as part of the methods I use in the thesis. This gives me the opportunity to understand laboratory work in general and to highlight possibilities for the sonic lab, thereby addressing my research question. I investigate the concept of the laboratory, its various names (e.g., studio, workshop, kitchen), and forms, including feminist labs, academic labs, and artscience labs. The feminist lab is described as a space that opposes patriarchal, colonial, and male-dominated structures, following Nash, Toupin, and Emerson. I also engage my hypothesis that laboratories can become mainstream places by studying the Thomas Edison Laboratory and Bell Labs. Both examples also allow me to consider the possible origins of the sonic laboratory. By analysing laboratory types, such as academic and artscience labs (the latter explored by Edwards), I have found that sonic labs already exist in the form of sonic academic labs and artists' residences within science laboratory types that produce sonic-centric outcomes. These two examples of existing sonic lab types are selected for further development in the next chapter.

Chapter 2 presents the case studies as a method in this research, organised into two sections: the artists' residences in the science labs (artscience labs) and the academic sonic labs. The first section presents four examples selected from Scott's *Artists-in-Labs* and Edwards's definition of artscience labs, as presented in Chapter 1. The selected artists are Robertina Šebjanič, Luca Forcucci, Pe Lang, and Ryoji Ikeda. For the second section, sonic academic labs, I present four examples: Sonic Lab UVic, Laboratorios Sonoros, Sonics Immersive Media Labs, and The Sonic Laboratory. Analysing sonic artists in laboratories provides me with the methods (e.g., field recording and prototyping) and outcomes (e.g., sound-centric components and curating) employed in laboratories to examine what constitutes a sonic lab. By studying academic sonic labs, I encounter different approaches to sound, including aesthetic and curatorial promotion, a critical enquiry into technology, and a sensorial and interdisciplinary approach. This enables me to further develop my thesis by examining the findings of this chapter in the next chapters: laboratory methods (Chapter 3), curating (Chapter 4), and field recording (Chapter 5).

Chapter 3 presents an analysis of various laboratory methods, building on the findings from Chapter 2. In this chapter, I work broadly, not only on sound methods, but within different laboratories methods, because I need to understand the possibilities of the sonic lab, as my research question asks. At this stage, I ask whether laboratory methods might influence and enrich a critical sonic laboratory. To answer this question, I review the methods identified in different laboratory types. For instance, I examine how learning by doing is employed in academic labs, following Dewey, and Beck and Bishop; how hackers use DIY in

hackerspaces as understood by Garret and Catlow, and Bogers and Chiappini; and how archiving is employed in media archaeology labs, following media archaeology theory by Jussi Parikka and others. I also demonstrate how other methods, such as experimentation (with examples from Latour and Weibel) and prototyping (as defined by Arrigoni, and Bradbury and O'Hara), challenge conventional laboratory methods. At this stage, the hypothesis is that sonic laboratories would achieve better results through collaboration, exchange, dynamism, and tolerance, thereby facilitating knowledge creation and societal and cultural development. This articulates the potential in the laboratory method to defy imposed views of culture and science. By exploring these methods, I understand sonic, artistic, and curatorial practices that can develop the potential to introduce new ideas and practices and to challenge conventions. In this chapter, one finding is the use of archiving as a method in media archaeology labs. This is of great importance, as archiving is understood within media archaeology, which considers technological artefacts (including sonic apparatuses) across planetary, temporal, and material scales. This enables me to consider the planetary laboratory, which will be developed in Chapter 5. However, I first need to address another laboratory method that is important for experimentation and workshop methods: curation. I proceed to Chapter 4, which continues to analyse laboratory methods but is specifically dedicated to curating, as discussed in Chapter 2, too.

Thus, in Chapter 4, I explore curating as a method applied in arts laboratories and others of this kind. Curating that concerns laboratories could be considered an experimental or institutional practice. I examine the laboratory's potential for curating and how it can overcome hegemonies within museum institutions. For instance, I aim to demonstrate curatorial practices through historical examples, such as *Experiments in Art and Technology* (curated by Billy Kluver), *Aerial/Sparks* (curated by Louise Manifold), and the exhibitions I curated under the title *Sounding DIY* (curated by Laura Netz, my artistic moniker). In Chapter 4, I also investigate whether contemporary curatorial alternatives can challenge institutional curating practice, following discussions and analyses by directors, artists and researchers such as Barr, Steyerl, Holmes, and Szeemann, to name a few. As a method, I present three examples of exhibitions that address three concepts that help answer my research question: the sonic in relation to laboratories, mediated through curating. Here, I see curating as a laboratory practice that challenges imposed views and presents sonically centred works in gallery/museum and other environments. This is important to this thesis, as I find that curating is a discipline that enables new laboratory modes, such as the exhibition lab. Can curating as an experimental practice provide practical examples of managing sound art in laboratories and develop the potential of a critical sonic laboratory? In the following and final chapter, I explore alternative laboratory methods to address this problem.

Chapter 5 follows the findings from Chapters 2 and 3, specifically. However, it is not a linear consequence of Chapter 4 but a side move of earlier chapters. It derives from the sonic laboratory examples I investigated in Chapter 2 (field recordings) and concepts derived from analysing laboratory methods in Chapter 3 (the planetary). Building on the analysis of artists in laboratories, I propose that field recording can be understood as a laboratory practice that operates outdoors. Thus, in this chapter, I employ an analytical method, drawing on various references, to examine the notion of the "planetary laboratory" and how it can inform the possibilities of the sonic lab. This perspective involves considering the environment by including non-humans and interspecies diversity, allying with Haraway's situated practices. The planetary entails considering planet Earth as a place where human action is extended from nature to technology, and to return to nature again, seen as a processual action that gives humans the responsibility of interacting with Earth. In this chapter, I follow Ewan Chardronnet, who is a pioneer in recognising and defining this laboratory from a techno-computational perspective; Bruno Latour, who proposes the concept of the planetary as a challenge to Anthropocene; Jussi Parrikka, who recognises planetary as well as temporal and material as conditions to analyse the technological artefacts, including sonic devices; and Brandon Labelle, who states that planetary consciousness is required to acknowledge the conditions of more than human life and proposes it as a decolonial concept. Findings of this chapter include the discovery of planetary sonic laboratories, with two practical examples, that produce new epistemological experiences of sound through lab practices.

In the Conclusion, I present the novelty about the sonic laboratory, and answer my research question, about the possibilities that entail working/creating in a sonic lab environment, following the findings and suggestions from the thesis: a feminist approach, a decolonial/anti-colonial perspective, a planetary scale and a situated and hybrid practice.

There are many important reasons why this investigation of laboratories is relevant and timely, and why exploring the sonic laboratory to study its potential and idiosyncrasies is appropriate and even urgent. First, I consider the laboratory to be where we literally shape the world, reconfiguring objects and producing beneficial social results. Second, I recognise it as a complex place not only dedicated to science but also having the potential to become hybrid and diverse, encompassing the arts, sound, nature, and more. Third, I understand how sound practices exemplify interdisciplinarity between sound and science, which aligns with my interest as a curator in developing alternative sonic practices in laboratory environments.

Furthermore, technology is a significant factor in laboratories, where innovation and progress are paramount. However, I position myself from an alternative perspective, drawing on the hacker/maker movement and DIY, and influenced by media archaeology theory,

where the scope of technology is revolutionary yet considers not only its progress and digitalisation but also its materialist aspects, from origins to consequences.

Additionally, I aim to focus on the feminist approach to technology and laboratories to understand how the sonic laboratory can serve as an alternative to masculine hegemony. With this in mind, I draw on feminist studies to examine how and why some theorists, hacktivists, and artists have developed an alternative view of the laboratory and created their feminist hacklabs. I therefore research whether feminist theory contributes to ideas around the sonic laboratory and, in doing so, propose a more alternative, inclusive, and hybrid space. I suggest that experimental methods, such as field recording, including listening practices, feminist theories, and planetary views, create an alternative and hybrid laboratory that can enable us to understand the full possibilities of the sonic laboratory as an interdisciplinary counter-laboratory.

1. Contextual review: Laboratory Precedents and Typologies

Introduction

Chapter 1 presents a literature review that provides an overview of laboratory types, from antecedents to contemporary examples, and includes a historical definition as part of the methods I use in the thesis. This gives me the opportunity to understand laboratory work in general and to highlight possibilities for the sonic lab, thereby addressing my research question. I investigate the concept of the laboratory, its various names (e.g., studio, workshop, kitchen), and forms, including feminist labs, academic labs, and artscience labs. The feminist lab is described as a space that opposes patriarchal, colonial, and male-dominated structures, following Nash, Toupin, and Emerson. I also engage my hypothesis that laboratories can become mainstream places by studying the Thomas Edison Laboratory and Bell Labs. Both examples also allow me to consider the possible origins of the sonic laboratory. By analysing laboratory types, such as academic and artscience labs (the latter explored by Edwards), I have found that sonic labs already exist in the form of sonic academic labs and artists' residences within science laboratory types that produce sonic-centric outcomes. These two examples of existing sonic lab types are selected for further development in Chapter 2.

This first chapter presents a survey of laboratory typologies to start this research narrative. It sets the scene and provides the references for future laboratory research, not simply as a fundamental site of scientific research and innovation, but also as a space of the arts, sound, the humanities, and technologies, and as a site for other ways of generating knowledge.

Therefore, in this chapter, I present and discuss various typologies of what is generally understood as a laboratory. This entails searching for historical precedents and considering the origins of their terminology and practices. In this survey, I present examples such as monasteries, apothecaries, and kitchens. In doing so, I explore what a laboratory was, even before it was named as such, including spaces typically designated as laboratories and other typologies such as workshops and artists' studios.

From there, this chapter explores already established laboratory typologies, such as academic labs, science labs, industrial labs, medialabs, hacklabs, and feminist labs. This research is conducted to determine the specific characteristics of each laboratory, understand how they operate, and identify the practices employed. This will help determine the sonic laboratory's possibilities and which practices to identify or, conversely, abandon.

This survey exemplifies the laboratory's origins in science, linking it to academia and finally to the arts. It also focuses on contemporary examples of laboratories, which could also be

critical of laboratory conventions, as they are generally related to science and technology, and which, as I will show, often lack female participation.

Therefore, I will add an investigation into feminist labs, responding to the dominance of male-defined laboratories and the lack of feminist practices[1] found when doing this survey work. Through feminist studies, I investigate and reveal an alternative to male-dominated laboratories. Through the feminist lab section of this first chapter, I propose a critical description of the laboratory, presenting an inclusive laboratory that inspires the potential of the sonic laboratory's critical aspects.

Through this survey work, I also encounter what will become a central focus of this thesis: hegemonic laboratory practices and characteristics. This identification describes laboratories that operate by imposing specific values and modes of work, thereby excluding other possibilities. I term them 'hegemonic laboratories'. In the course of the thesis, I elaborate how these hegemonic labs present a problem for art and knowledge production, as they identify with male-dominated spaces that, through strictly conventional scientific and colonial practices, impose specific ways in knowledge production processes and laboratory behaviours. Thus, they exclude other knowledge pathways that entail object quantification as a control strategy promoting competition as opposed to a feminist "co-operation" (Haraway, 1991, p.93). Subjective knowledge considers the feminist social approach of collaboration mediated through situated practices against imposition models.

In Chapter 2, I propose that the sonic laboratory might respond critically to such hegemonies based on this identification and its exclusive knowledge frame. Such sonic intervention possibilities will become the subject of the second chapter.

However, to start this research, in this first Chapter (Chapter 1), I am presenting my research on a laboratory typologies survey, which entails disclosing different laboratory types, identifying patterns of behaviours, features, and particularities, and identifying general conditions common to all laboratory types.

1.1 Historical Precedents: Monasteries, Apothecaries, and Kitchens

The term laboratory was first used in apothecaries, monasteries, and kitchens. Apothecaries date back to ancient Babylon, but as I will show, the first laboratories were built in the Benedictine monastic community in St. Gallen, Switzerland (747 AD). Then, during the

[1] White heterosexual male domination promotes unbalanced practices in laboratories; male-dominated laboratories generally exclude women, bisexuals, trans and queer people; also, Black and Asian communities have been discriminated in laboratory institutions (for example, in CERN-affiliated countries, there is only Israel present). There is a lack of representation of otherness in laboratories, such as happens in the STEAM and STEM communities. As Lewis states, "a similar imbalance in the number of girls and women pursuing study and careers in STEM and computing subjects" (Lewis, 2015, p.1).

eighteenth century, apothecaries evolved into academic and science laboratories. At the University of Oxford (1860), the kitchen was later converted into a laboratory for metallurgy, marking the birth of the industrial laboratory. These early examples of laboratories provide the starting point for my survey and articulate the basis for understanding laboratories. They provide the historical foundation for the remainder of the thesis.

The etymology of the term laboratory comes from the Medieval Latin *laboratorium*, from Latin *laborare* (to labour) (Merriam-Webster, 2025). Historically, the word laboratory was *elaboratory,* but this usage is now obsolete. *Elaboratory* comes from *elaborare,* the physiological role of some natural apparatus for elaborating any product. Clara Bofill (2013) reaffirms that *laboratorium* refers to labour or work:

> If we delve into the origins of this word, we find that the Latin laboratorium means a place for labour or work and that the verb laborare means to work, produce, or cultivate. In the 18th century, for example, the word "laboratory" was used to describe the studios of painters, sculptors, and printmakers, as well as, more generally, any place in which people made things with their hands. Nowadays, the use of this term has spread into many different spheres: photographic lab, language lab, film lab, arts lab, cultural lab, and so on. Moreover, more recently, new types of spaces and departments have been springing up with the term integrated into their name: Medialab, Hacklab, Crealab, ArtScience Lab. (Bofill, 2013)

This quotation helps me articulate the term laboratory's openness. It is a diverse and multiple term, recurrently associated uniquely with the sciences. The broadness or multiplicity of the term laboratory will be discussed later in this chapter, as I need to understand its historical precedents first.

Livio and Emerson said laboratories emerged in monasteries and apothecaries in the sixteenth century. Most references to laboratories predate the late nineteenth century. These are sites of technical knowledge production and experimentation. Livio and Emerson describe monasteries, workshops, and kitchens as "proto-lab spaces" (Livio and Emerson, in Bogers and Chiappini, 2019, p.287).

Wershler, Emerson, and Parikka describe monasteries as the first laboratories, citing, as I did above, the monastic community in St. Gallen, Switzerland. The documents describe this Benedictine monastery as having many of the elements one would expect to be in a laboratory, and "the Plan of St. Gallen also specifies the production of a space dedicated to a range of labors and laborers" (Wershler, Emerson, Parikka, 2021, p.48). The reference to labour corresponds to the earliest definition of a laboratory as a workplace.

Another precedent for modern laboratories are apothecaries. These date back to ancient Babylon but emerged in the fifteenth and sixteenth centuries as professional organisations dedicated to manually preparing and selling medicines. In some respects, they anticipate academic and industrial laboratories in later centuries. Ursula Klein defines apothecary laboratories as places of manufacture and enquiry. During the eighteenth century, apothecaries evolved into "academic-chemical laboratories" (Klein, 2007, p.262). They were sites of academic and scientific discovery, where one could practice chemistry and develop pharmaceutical treatments.

Another historical reference to the laboratory is the kitchen. In 1860, the University of Oxford extended its science museum by attaching a new chemistry building informally called a laboratory, named and modelled after the Abbot's kitchen. Wershler, Emerson, and Parikka explain that "This kitchen/laboratory space (…) is an appropriate spatial allegory for the genealogical relationship between the modern lab and earlier articulations" (Wershler, Emerson, Parikka, 2021, p.52). The kitchen was also a place for "'gentlemanly' experimentation" (Livio and Emerson, in Bogers and Chiappini, 2019, p.287) during the eighteenth and early nineteenth centuries, despite being more commonly seen as a woman's domestic space.

In 1881, the kitchen was also used as a synonym for laboratory in metallurgy (the science that studies the behaviours of metals). In Gooday's words, "In metallurgy, the laboratory is the particular space defining the relation between the fire and flue bridges; it is also, not insignificantly, known as the 'kitchen' or 'hearth'" (Gooday, 2008, p.790). Here, the industrial laboratory definition resembles the term kitchen used in metallurgy.

Moreover, as early apothecaries and academic-chemical laboratories became large-scale manufacturing sites, they fundamentally transformed into industrial labs. As Klein states, “there was also a continuous transition from small-scale pharmaceutical manufacture to the large-scale pharmaceutical industry” (Klein, 2007, p.275). Thus, apothecaries and academic-chemical laboratories serve as precedents for the modern academic lab, historically linked to the science lab. Science labs are also the foundations for the modern industrial lab. The link between these three laboratories (academic, scientific and industrial) is historically intertwined; sometimes, the boundaries are blurred. Together, they define a laboratory model that has become popular and widespread as the most recognised model and type of laboratory that has gained recognition in recent decades, perhaps, as I will discover during my research, imposing methods and excluding others.

Following the history of the laboratory, I can explore and trace a contemporary use of the term laboratory, as referred to in Clara Bofill (Bofill, 2013). Nowadays, laboratories entail

various typologies and practices: art labs, hacklabs, and tech labs, which turn the laboratory into a hybrid space. In my research, I aim to encounter a definition of the laboratory that opposes the more extended view of the laboratory that is associated with science.

Therefore, to develop a hybrid definition of the term laboratory, I have studied the works of Wershler, Emerson, and Parikka, which explore laboratories from different perspectives. Looking at the contextual situation of medialabs, the authors examine the term laboratory and establish a new concept: the "hybrid lab" (Wershler, Emerson, and Parikka, 2021, p.7). Roger Whitson, in his review of the hybrid lab term, states, "Instead of being limited to the scientific lab, [the] hybrid lab […] feature[s] makerspaces, media archaeology labs, teaching and research collections, home economics labs, black agricultural extension labs, and parapsychological labs" (Theory, Culture and Society, 2023). The term hybrid lab encompasses open and broad definitions, with values like inclusivity and diversity.

Moreover, Wershler, Emerson, and Parikka introduce feminist studies into laboratory studies as well as Marxist theory, following the example of Henri Lefebvre, which define the laboratory as an open concept, malleable, determined by the practices, contexts, and people that develop it. As the authors state,

> Labs have never been static, unchangeable, unitary entities with clear-cut histories. They are—and have always been—shaped by communities of people both inside and beyond their walls, by these same communities' intellectual trajectories, and, of course, by the labs' physical locations and configurations. (Wershler, Emerson, and Parikka, 2021, p.37)

This complex perspective, which is derived from studying the historical precedents and the overview of contemporary laboratories as inclusive and hybrid spaces, allows me to rethink laboratories in a critical position instead of a standard view, also permitting the identification and criticism of hegemonies and conventions of specific institutional laboratories.

In the next section, I delineate the attributes of academic labs as intertwined with science labs, elucidating how they have progressed and acquired distinctive characteristics, drawing inspiration from the historical precedents set by early apothecaries.

1.2 Academic Labs

Academic labs can be defined as buildings that “are living laboratories that advertise, enable, excite and inform everyone within range. They include both research and teaching labs” (Whole Building Design Guide, 2020).

The academic lab has a role in modern education, and its origins are in medieval monasteries, apothecaries, and kitchens. For Avi Hofstein and Rachel Mamlok-Naaman,

academic labs are places to "develop students' abilities and skills" (Hofstein and Mamlok-Naaman, 2007, p.105). Some laboratory activities are designed to engage students individually, whereas others are designed to engage students in small or large groups. The academic lab connects with the world of science, which emerges thanks to the workshops' central role, which is to organise and focus on specific experiments. Such laboratories are sites to conduct investigations, and their development occurs through experimentation, which will largely be a constant feature of most laboratories.

One example of an academic lab that is not related to a scientific methodology and dedicated to the study of psychology is “the laboratory of Wilhelm Wundt (1832-1920) at Leipzig” (Bringmann and Ungerer, in Nicolas and Ferrand, 1999, p.194), founded in 1879. At Wundt’s laboratory, students attended “to study the experimental techniques” (Nicolas and Ferrand, 1999, p.194) in psychology. Attending Wundt’s laboratory, there were “medical students and candidates for a Ph.D. in science” (Biervliet, in Nicolas and Ferrand, 1999, p.197); others were concerned solely with education in philosophy, “lawyers, and even professors of primary education” (ibid.). Wundt’s laboratory was “the first institute of experimental psychology, the first laboratory of research opened to students” (Van Biervliet, in Nicolas and Ferrand, 1999, p.196). The laboratory was founded thanks to the generosity of the Saxon government. Wundt built a laboratory that “was able to fit out premises, buy essential measuring apparatus, and give the first practical training in psychology” (ibid.).

Many of Wundt’s laboratory features, such as experimentation, research, and work with apparatuses, turn this experimental laboratory into one of the first non-scientific laboratories existing in Europe at the fin de siècle. This research identifies these features as contributing to the academic laboratory's definition as a place for knowledge and learning, not restricted to the sciences but also to the humanities, thereby broadening laboratory possibilities. In doing so, the laboratory is identified not only as a space of appliances reduced to scientific works, but, with Wundt’s experimental academic psychology lab as an example, as a place for developing research in the humanities, as I explain in the following paragraph. The *Manchester School of Social Anthropology* and the *Institute for Research and Coordination in Acoustics/Music* (IRCAM) are examples of humanities labs. Also, IRCAM (Institute for Research and Coordination in Acoustics/Music) will be examined later in this chapter as an example of an arts and music laboratory developed by artists and musicians and situated within the humanities.

The term "humanities lab" refers to academic labs as sites for learning and cultivating a culture of knowledge. In developing humanities theory and cultural studies through collaboration with artists and humanists, humanities scholars conduct research to produce knowledge. In academic labs, as in humanities labs, “the collection of apparatuses in

research and teaching collections, […] is one example of the longer history of humanities infrastructure that has reemerged recently in the context of digital humanities" (Wershler, Emerson, Parikka, 2021, p.82). In addition to this, researchers who focus on the study of digital humanities (DH) labs state that they "produce and [are] produced by a network of scholars, practices, institutions, epistemologies, ideologies, and cultures of STEM, the Humanities, higher education, and society" (Malazita, Teboul, Rafeh, 2020). Following this definition of digital humanities labs, the authors also suggest how "Labs must contribute to the legitimisation of lab practices and material products for particular epistemic cultures in the Humanities" (ibid.). This quote refers to the production of knowledge, and the systems of knowledge in humanities labs, which become understood as the result of producing "documentation, contextualisation, and subjectification. DH scholars, DH journals, and DH audiences are as much an outcome of laboratory work as an artefact" (ibid.). The DH lab definition describes these research environments as "epistemically active spaces" (ibid.), meaning and corroborating the importance of the laboratory as a space of transformation in processes of knowledge production and social modification. However, this definition offers a vision of "alternative disciplinary spaces where DH work can be practised and alternative objects of DH research [obtained]" (ibid.). Here, I find the first definition of the laboratory that helps me understand the possibilities of an alternative mode of producing knowledge in the humanities. Additionally, this broader definition of the laboratory, which includes the humanities, allows me to rethink the sonic laboratory using humanities disciplines and approach knowledge production differently than only the science laboratory model.

Studying the academic lab reveals other examples, such as the American academic lab, which emerged from the confluence of industry and academia. However, this model is another example of the scientific laboratory, as it reaffirms the values of the industrial-military-academic complex. According to Wershler, Emerson, and Parikka, "Most American universities founded in the mid to late nineteenth century were created in the spirit of entrepreneurialism" (Wershler, Emerson, Parikka, 2021, p.156). This entrepreneurialism is intertwined with military interests as universities evolve into research hubs funded by the military, seeking to capitalise on knowledge production. This transformation connects various fields, including the arts, agriculture, manufacturing, and commerce, and increasingly aligns with modes of knowledge production centred on industry, the military, and science.

> The Paris-based artists Léonore Bonaccini and Xavier Fourt, who form the duo Bureau d'Études, speak of a "laboratory planet," which, besides designating the twentieth-and twenty-first-century science-military-entertainment-university complex as the defining planetary situation that installs infrastructures of power and

> technology, also refers to the laboratorization of knowledge in general (Wershler, Emerson, Parikka, 2021, p.191)

Entrepreneurialism presents the academic lab as legitimising practices, perpetuating a model developed by industrialist-capitalists prioritising profit maximisation and market dominance. According to Wershler, Emerson, and Parikka:

> MIT's 1861 founding charter states that the fledgling polytechnic institute is being created 'for the purpose of instituting and maintaining a society of arts, a museum of arts, and a school of industrial science, and aiding generally in … the advancement, development and practical application of science'. (…) The founders elaborate on how the need to keep pace with (if not outdo) the European economy hinges on a tight connection between 'intelligent culture' and 'industrial pursuits'. (…) The way early MIT labs emphasized experimental, mechanical research and strove to avoid the appearance of pure intellectuality anticipated the ethos of Edison's Menlo Park laboratory (…) the lab [that] was funded almost entirely by entrepreneurs and venture capitalists eager to see a return on their dollar, one of Edison's most famous aphorisms was 'You got to make the damn thing work'" (Millard in Wershler Emerson, Parikka, 2021, p.156-157).

Wershler, Emerson, and Parikka criticise this model of "American universities' appropriation of business management techniques to handle their administration" (Wershler, Emerson, Parikka, 2021, p.164). American universities could represent an academic lab developed through research apparatuses fused with entrepreneurialism. This model of the university/academic lab is based on policies that prioritise financial benefits and profit. Wershler, Emerson, Parikka refer to how "this view [of] the university is conceived as a business house dealing in merchantable knowledge, placed under the governing hand of a captain of erudition, whose office it is to turn the means in hand to account in the largest feasible output" (Veblen, 2010, cited in Wershler, Emerson, Parikka, 2021, p.164). They identify this university's knowledge production model with industrial and science labs under market capitalism, production for profit, and efficiency and profitability parameters. Hypothetically, this model became hegemonically instituted among most, if not all, American universities, and such standardisation identifies them with practices of objectifying colonialism and foundational capitalism.

In response, I suggest that an alternative model could prioritise the societal impact of research, fostering experimentation (as in Wundt's psychology laboratory) and the humanities labs, among others, such as interdisciplinary (as seen in DH labs). To arrive at this alternative mode, in the next chapter, I survey other academic labs that differ from the

American university model. To do so, I will investigate the laboratory concept through examples that present sonic laboratories in academic environments. Examining contemporary academic laboratories dedicated to sound art practice, already named sonic laboratories, requires further investigation. These are Sonic Immersive Media Labs at Goldsmiths University, the Sonic Lab at the University of Victoria, Laboratorios Sonoros at UNAM, Mexico, and The Sonic Laboratory at the Sonic Arts Research Centre (SARC) at the University of Belfast. Such sonic laboratories can, as I hope to show, represent an alternative to entrepreneurially/militarily constituted laboratories. In the next chapter, I explore how sonic laboratories can critically approach those academic labs based on American university models.

In the next section, I explore the characteristics of science labs, which resemble academic labs, and promote future laboratories such as industrial and medialabs. I suggest that there is a direct link between the academic lab and the science lab. I pursue this idea by tracing back to early apothecaries, which first developed towards academic-chemical laboratories, establishing an academic scientific laboratory model that has existed until now.

1.3 Science Labs

Laboratories are workplaces, but their conventional definition is generally associated with technology and science. As specified by the Encyclopaedia Britannica, a laboratory is a "Place where scientific research and development are conducted and analyses performed, in contrast with the field or factory" (Britannica, n.d.).

The origins of science labs are in the chemical laboratories that appeared during the eighteenth century in Europe. In her study, Klein presents as an example "the chemical laboratory of the Berlin Academy of Sciences [founded in] 1753" (Klein, 2007, p.247) that A.S. Marggraf directed. The origins of the science lab connect to the world of chemistry, early apothecaries, and academia. Klein defends this by saying that, "Laboratories, pharmaceutical and academic-chemical, were the institutions where manufacture or technological inquiry and inquiry into nature were firmly entwined" (Klein, 2007, p.250).

These academic chemical laboratories are the foundations for the contemporary science lab. Among the techniques used in chemical laboratories is "the chemical investigation of nature, or to perform chemical analyses alongside pharmaceutical manufacture" (Klein, 2007, p.251), which will go on to establish science labs' methods. By the nineteenth century, academic labs enabled "chemical inquiries into nature [and] to explore the possible uses of their insights in the pharmaceutical art" (Klein, 2007, p.270). Through manufacturing, academic chemical laboratories turned into pharmaceutical laboratories. The chemical laboratory "was mainly a place of natural inquiry and technological investigation, but only

exceptionally a site of manufacture" (Klein, 2007, p.271). While academic chemical laboratories focused on experimentation and nature investigation, pharmaceutical laboratories evolved from manufacturing to industry, establishing the foundations of industrial labs. However, according to Klein, modern technoscience differs from early academic chemical laboratories. As she states,

> …modern technoscience and the large pharmaceutical companies of the twentieth and twenty-first centuries [have] a marked difference of their production apparatus from chemical research instruments, the professionalisation of 'scientists', and the complex network of institutional mediation between science and technology. There seems to be a huge gap between the early form of eighteenth-century technoscience described above and present technoscience (Klein, 2007, p.273).

Klein's critique of the modern pharmaceutical industry centres around the hegemonic nature of its laboratory model, which is deeply connected with modern technoscience and dominated by large corporations. The term hegemonic refers to the industry's influence and control over laboratory processes, scientific research, knowledge production, and societal development. By critically examining these aspects of the industry's laboratory model, Klein raises essential questions about the need for a more ethical and equitable approach to laboratory processes. I critically review these models in the following chapters. The critical review of these laboratories aims to discuss and address the power imbalances perpetuating hegemonic control. Subsequently, this enables me to advance discussions on looking for alternatives to laboratory processes that can enhance a more socially just and equitable paradigm.

Moreover, Philip Bell studies the development of laboratories in academic environments, but only those related to scientific investigations. Bell describes science labs as places for experimentation and "'lab work'" (Bell, 2004, p.2), which are the foundations for scientific investigations. They also support teaching and building epistemological learning, primarily through hands-on experimentation. Other methods in science labs "are embedded in a broader context of inscriptional work associated with the communication and publication of results" (Latour and Woolgar, 1986, cited in Bell, 2004, p.10). According to this, science behaves in a chain production from facts to literature, using experiments and registering simulations, and finally building black boxes, which have an impact on social consequences.

Bruno Latour's laboratory definition introduces the notion of "counter-laboratories" (Latour, 1987, p.79). Counter-laboratories will continue to appear in this research as they frame a laboratory concept that defies conventional, industry, and finance-based laboratory practices. This research will discuss whether counter-laboratories can propose a hybrid and alternative

laboratory type. As examples of counter-laboratories, this thesis considers hackerspaces and hacklabs as places where not only scientists operate and work but also artists, hackers, and coders, among others. Alternative and counter-laboratories characteristics will be investigated to explore the possibilities of a sonic laboratory.

However, as mentioned above, not only scientists work in laboratories. There is a historical connection between artists and science since Humanism and the Renaissance, when artists were educated in science as well as other disciplines. Indeed, the artist's studio has been considered a laboratory, a place of experimentation and of science. This exciting aspect of the science lab makes the connection between the arts and science evident. There is a historical connection between production sites in science and art, as Peter Galison describes. He states that artists and scientists responded to Romanticism's vision of a solitary creator, and the role of the artists working in the studio was assimilated (in)to the role of the scientists in the laboratory. In Galison's words, "The artist's studio became the site of creation most privileged in narratives of humanist individualism, paralleled occasionally by images of the modern laboratory such as the 1899 photograph of Nikola Tesla in his Colorado Springs electrical lab" (Galison and Jones, in Galison and Thompson, 1999, p.509).

Following Galison (Galison and Jones, in Galison and Thompson, 1999, p.498), from the 1940s to the 1980s, artists and scientists shared similar spaces and experiences, and the products of such spaces bound science and art together. In this way, art and science labs grew in parallel, and following Galison, laboratories and studios shared certain features. Both were …

> …sites of introspective and solitary meditation patterned on religious retreats: Mendel's literally monastic settings of the late nineteenth century, Delacroix's Michelangelo in his cerebral studium, the mid-twentieth-century European cosmic-ray physicists clambering ever higher into their alpine huts, or the Abstract Expressionist painters' veiling of their industrial lofts as spaces staged for confrontations with the existential void (Galison and Jones, in Galison and Thompson, 1999, p.530)

According to Galison (Galison and Jones, in Galison and Thompson, 1999, p.510), the modern "laboratory/studio" has its equivalents in "the French atelier, Italian bottêghe, and the British workshop" (ibid.), and these are sites of individual creation resembling "the premodern alchemist[s]" (ibid.) place of experimentation. As spaces of private use, all these laboratories or artists' studios have in common "a structural similarity to the genial space established for the Romantics' Michelangelo and later adapted for the Abstract Expressionist

generation in New York" (ibid.). As Pollock expressed in his painting *Alchemy* in 1947, these spaces are remarkably similar "to those sanctuaries of laboratory life" (ibid.), which resemble early apothecaries that preceded science labs, spaces of nature experimentation where alchemy was used as a methodology. This gives laboratories an aspect of mystery and an aura that compares to artists' creativity in studios. This interpretation represents the similarity between laboratories and studios. It reinforces the thesis's ideas about the term laboratory as hybrid and complex, and about the laboratory's diversity, inclusivity, and richness, referring to interdisciplinary fields and not just purely science.

The connection between art and science is a phenomenon that can also be observed in "artscience labs" (Edwards, 2010, p.8). According to David Edwards, the "artscience lab resembles the early twentieth-century German art school known as the Bauhaus, where ideas in the arts and design [were] advanced through phases of experiential learning, cultural exhibition, and production, with students working alongside master artists and designers" (ibid.). The model proposed for arts and design development through interdisciplinary regimes allows collaboration rather than imposing separate paradigms. Artscience labs are generally defined as places for scientific and technological development where artistic practices take place, thanks to residency programs and grants funded by the government. Artscience labs develop in the exchange between artists, scientific institutions, research centres, and places to study science and tech. They also have a political dimension, which is generated through governmental funding.

As interdisciplinary laboratories, artscience labs represent a possible model to study and analyse, as there are already existing examples that develop sound art practices. Some sound artists participate in the artscience labs, and the results and methods used in this type of residency will be developed in the next chapter, Chapter 2, through four sonic laboratory examples, considering artists Robertina Šebjanič, Luca Forcucci, Pe Lang and Ryoji Ikeda. Most artscience labs develop through an interdisciplinary approach that represents a collaborative model, rather than only science-based research, which is still favoured in examples of science labs and industrial labs. In response, this research, and particularly the artistic practices to be examined in the next chapter, aim to articulate and argue the sonic laboratory as expanding and augmenting the possibility of the laboratory and offering an alternative mode of working across the arts and sciences.

Before moving to these examples, in the next section of this chapter, I analyse the origins of industrial labs in the nineteenth century, establishing how the industrial lab follows the science lab as a place of manufacture and production. I then show how industrial labs' origins are found in the evolution of kitchens, academic, and scientific labs. In this investigation of industrial labs, I will realise how these labs are important for the emergence

of sonic labs. I will explore Edison and Bell Labs as the origins of sonic laboratories, but I will also understand the need for a contemporary and critical reidentification of sonic laboratories, adopting other techniques and philosophies that move away from the historic institutions of earlier laboratories, such as Edison and Bell Labs.

1.4 Industrial Labs

My survey of industrial labs starts with the examples of Bell Labs and the Thomas Edison Laboratory: "Edison built an industrial research laboratory (…) that remained unsurpassed until the twentieth century" (Rutgers School of Arts and Sciences, 2016). However, Bell and Edison laboratories are also examples of early sonic laboratories where industrial manufacturing processes, research, and investigation into sound apparatuses were conducted.

Historic laboratory examples, such as Bell Labs and Thomas Edison Laboratory, represent an industrial lab model developing sonic technologies. Sound reproduction technology is vital in their developing industrial laboratories. Exploring these laboratories and understanding how they produce sound reproduction technologies will be significant in envisaging a sonic laboratory. Bell and Edison laboratories are examples of possible sonic laboratories.

As I will discuss in this chapter, Bell Labs could be explored as an industrial lab that originated in the nineteenth century. I understand its establishment as a possible origin of the sonic laboratory in a proposed history of the laboratory and the context of sonic technologies. In turn, I contend that contemporary industrial labs benefit the development of sound art practice by allowing collaboration with artists in events and exhibitions (for example, in *Experiments in Art and Technology*, the art event which resulted from the confluence and working together of artists, scientists, engineers, and curators at the Bell Labs). Thus, sonic reproduction technologies are intrinsically embedded in laboratories but also develop art practice, making science and sound an interdisciplinary practice in a laboratory environment. Chapter 4 will further explore this industrial lab collaboration with artists, where I investigate the relations between laboratories and curators. For now, I will build the foundation for these arguments by considering the industrial lab through the example of Bell Labs.

Bell Labs was a laboratory focused on analysing, recording, and transmitting sound. In 1893, Alexander Graham Bell constructed a new building to house the laboratory. Bell Laboratories was the premier facility of this type, developing a broad range of revolutionary technologies. Bell Labs is credited with the invention of radio astronomy, the transistor, the laser, the photovoltaic cell, information theory, the UNIX operating system, and the

programming languages C and C++. Bell's evident influence in constructing the definition of a possible sonic laboratory is critical since it is a pioneer in the research and development of audio, sonic technologies and sound devices.

Moreover, these inventions led to the development and pioneering of digital computer music. Researchers such as Max V. Mathews and John R. Pierce collaborated with several visiting composers, who were allowed to use the computer facilities when they were not used for research and other official work. Some visiting composers were James Tenney, Jean Claude Risset, Emmanuel Ghent, Laurie Spiegel, and John Cage.

Artists and sound artists, through artists' residences in laboratories collaborating with scientists and engineers, will be discussed in Chapter 4. The survey and discussion of sound artists' active involvement in industrial labs and other laboratory types will allow this research to critically explore the potential of the sonic laboratory. Bell Labs demonstrated how the transmission of communication transformed art and sound, and how these laboratories contributed to the emerging aesthetic of sound art.

Another example of an industrial lab is the Thomas Edison Laboratory. Edison opened two major laboratories at Menlo Park and West Orange in New Jersey in 1876 and created a freestanding industrial research facility incorporating a machine shop and other laboratories. While working on the telephone in the summer of 1877, Edison discovered a recording method, and in the late fall, he unveiled the phonograph. Livio and Emerson define Menlo Park as a "19th century (…) all-male industrial research laboratory" (Livio and Emerson, in Bogers and Chiappini, 2019, p.288). It was also called an "invention factory" (ibid.). Founded as a "private lab" (ibid.), Menlo Park "drew on the spatial, infrastructural, and administrative organisation of labs and, with its frenzied embrace of entrepreneurialism and innovation, laid the groundwork for most of the major technology-based labs to come in the 20th century" (Wershler, cited in Livio and Emerson, in Bogers and Chiappini, 2019, p.288).

Following the same idea of late nineteenth-century industrial labs as foundations for contemporary laboratories, Emerson defines how introducing Menlo Park laboratory's management techniques evolved into the MIT Media Lab model that emerged in the 1980s. Simultaneously, the MIT Media Lab "paves the way for the mainstream North American corporate innovation lab model that continues today" (Wershler, Emerson, Parikka, 2021, p.151). This research employs a mainstream laboratory model to study and critically oppose it. But, although Edison's model is seen as a mainstream laboratory model, which means hegemonic and entrepreneurial, Edison's work is also critical in defining and establishing the concept of a sonic laboratory. According to Paul Israel,

> At Menlo Park, it was not just the phonograph but also acoustic telegraphy, the telephone, and several other acoustic devices that Edison worked on after inventing the phonograph. Furthermore, at West Orange, what started as the lecture room on the third floor became a sonic laboratory as they experimented with recording on the wax cylinder phonographs, and then in 1910, this became the test room for the Edison recording industry. (Israel, 2020).

Edison Laboratory and Bell Labs continued using sound technologies in the nineteenth and twentieth centuries, establishing a laboratory model for other emerging laboratories, such as the medialab. The continuity from the nineteenth to the twentieth-century laboratory continues, extending this model of profit vs. collaboration. It imposes a business-centred model that prioritises benefits, as seen in the American university academic lab model. According to the Bureau d'Études, this model of a laboratory factory expands geographically and temporarily:

> Since World War Two, the planet is gradually transformed into a scale laboratory. The old model of 'world factory' has given way to the model of the 'world laboratory.' Objects of this laboratory, can we also be the subjects? Can we reclaim this huge machine that became autonomous and is now developing according to its own dynamic? Can we redirect the fate and direction of this laboratory? (Laboratory Planet, n.d.)

Large-scale industrial labs expanded worldwide, promoting technological expansion and resource extraction on a planetary scale. Hence, a planet laboratory refers to the complex of science, military, industry, and university institutions that collectively established infrastructures of power and technology, influencing global dynamics and societal structures. Edison Laboratory's work exemplifies an industrial lab primarily focused on developing planetary applications, including lighting, communication, manufacturing, and other fields, which have extended beyond its immediate surroundings to influence societies, economies, and the planet. The notion of the laboratory's planetary scale will be studied in Chapter 5 to understand whether the planetary scale consciousness can benefit the idea of a sonic laboratory and whether, in turn, the sonic can expand the planetary outside the laboratory, including also field recording.

Specific industrial labs, such as Bell Labs and Thomas Edison Laboratory, have greatly influenced the development of medialabs: laboratories that focus on media technologies and advancing these through parameters of innovation and research. This laboratory type enjoys social recognition and reputation by perpetuating certain technoscientific practices. For the development of medialabs, industrial labs are joined with academic labs. For this reason, in

the next section of this chapter, I will study medialabs. As part of this investigation, I will consider how medialabs and other models, such as hacklabs and hackerspaces, despite or through their vicinity to the industrial lab and its capitalist orientation, defy the hegemonic aspect of industrialism/the industrial lab.

1.5 Medialab, Hacklab, and Other Typologies

The historic MIT Media Lab is one of the pioneers of medialabs and possibly where the name medialab was first defined. The MIT Media Lab emerged from the late nineteenth-century laboratories, a mix of academic, science, and industrial labs. Nevertheless, it "was a continuation of a long legacy of art and technology labs at MIT" (Wershler, Emerson, Parikka, 2021, p.61), such as the Centre for Advanced Visual Studies. However, as in the case of both the Thomas Edison Laboratory and Bell Labs, "the naming of the lab wanted to position itself as part of the lineage of private-sector technology labs" (ibid.). The MIT Media Lab represents a continuation of the Thomas Edison Laboratory, maintaining the same values and status, with the same methods and success, while also adapting the legacy of private and institutional laboratories. According to Wershler, Emerson, and Parikka,

> The space of the MIT Media Lab bears a strong resemblance to those historical entities that explicitly referred to themselves as labs in order to give it a certain coherence or make it resonate with a particular lineage of labs. Like Menlo Park, the MIT Media Lab contains many open, closed, and porous spaces for hands-on experimentation: a wood shop; a metal shop; areas for spare parts; a kitchen; an area for recreation and socializing; and administration offices. Unlike Menlo Park, it also has a lecture hall as well as designated areas for exhibitions, receptions, and conferences. All the same, given its fairly obvious ties to historical precedents in both name and spatial design, it is odd that its discourse desires complete ownership of the term “media lab” despite the existence all over the world of myriad other, unaffiliated media labs. (Wershler, Emerson, Parikka, 2021, p.63)

Furthermore, according to Chris Schmandt, the MIT Media Lab is where…

> …we employ supercomputers and extraordinary input/output devices to experiment with today, with the notion that these will be commonplace tomorrow. (…) The lab explores issues in a broad range of new information technologies, including: advanced digital television, electronic publishing, portable computing and communication, artificial intelligence, voice interfaces, user interface design, and education-related technologies. (Schmandt, 1996, p.133)

Apart from working and researching with these technologies, MIT was formed by other laboratories such as the Architecture Machine Group (AMG), started by Nicholas

Negroponte, the Media Labs Director; the Visible Language Workshop (VLW) with, at the time, a particular interest in print media. Also joining MIT from elsewhere were Seymour Papert, Marvin Minsky, and Bamy Vercoe, who founded the Experimental Music Studio. The Experimental Music Studio at MIT is an example of a media and academic lab experimenting with sound, music, and sonic practices. There was also a film/video section under Ricky Leacock and Stephen Benton, rising from the ashes of the former Creative Photography Lab. The staffing/directorship of these laboratories reveals a white male-dominated environment, which is critically reviewed in Chapter 1's section on feminist labs.

At MIT Media Lab, interdisciplinary science and arts brought artists, scientists, and engineers towards a unique aim: to develop participatory and innovative technological practices. Moreover, after the Thomas Edison Laboratory and Bell Labs, the MIT Media Lab's studies and practices with music represent a possible sonic laboratory model. I will explore whether the potential of the sonic laboratory I am researching aligns with or distinguishes itself from the MIT Media Lab model.

Other laboratory models, such as hacklabs, hackerspaces, makerspaces, fablabs, and biolabs, are all variants of the medialab and began to appear in the middle of the 1990s. Their origins are linked to the emergence of the personal computer. Hackers collaborated with MIT and founded the free software movement. One example is Richard Stallman, who launched the GNU Project and the Free Software Foundation.

Hacklabs and hackerspaces are hackers' places, and are generally self-managed spaces. Their interest lies in technology, and their practice evolves through meetings, sharing, and creating knowledge in both collective and individual projects. An indisputable feature of these hacklabs and hackerspaces is the collective use of open-source software and hardware. Through sharing and free licenses, hackers' use of open-source is seen nowadays as an alternative to the imperative and profit of the big five technological corporations (Amazon, Apple, Facebook, Google, and Microsoft). Thus, in contrast to the laboratory conventions of American universities and the Edison laboratories, hacklabs and hackerspaces can be understood as proposing alternatives that question the hegemonic models of corporate behaviour for profit.

Here, I demonstrate how hacklabs and hackerspaces' ethos represents such a resistance. Many artists have joined hackers' practices, developing alternative laboratories which represent a 'maker culture' rather than making a profit. Makerspaces interrogate issues around financial sustainability, staffing, and office culture. According to these authors, "The concept for the lab grew out of a question of how a hack can be extended into a physical space that supports the kinds of practices that would occur in a more temporary space. (…)

interruptibility, openness and generosity (…) sustain the lab environment" (Bradbury and O'Hara, 2020, p.7).

Makerspaces and fablabs, also named Fully Automated Business (FAB) or Fabrication Laboratories, do not use uniquely open hardware but can provide precise machines: “These include a laser cutter for making 3D structures from 2D designs, a large CNC mill for making furniture and housing, a NC knife and smaller mini-mill for making circuits and moulds for casting, 3D printers, an electronics workbench, and a suite of tooling and materials that allows anyone, anywhere to make almost anything” (FabFoundation, 2024). According to the dossier Soberania Tecnologica, these potentially do not opt to transform the system but for "a re-updating of capitalist production and consumption relations" (Gastfall and Fourmond, 2014, p.89). This aspect of fablabs will be addressed through feminist labs, which oppose a view of a laboratory based on female presence being obliterated.

Tania Aedo provides some examples of sonic practices developed in these alternative types of laboratory environments. Aedo states that maker, hack, and DIY culture should be reactivated in the laboratory. Artists are makers who trespass the critical thresholds, crossing disciplinary boundaries. Even though Aedo provides sonic practices as examples, she reinforces the interdisciplinarity in these laboratories, integrating different disciplines such as media art, sound art, conceptual art, media archaeology, expanded cinema, new materialism, experimental electronic music, and critical theory. Aedo presents examples of developing sonic practices in hacklabs that can become examples of a hypothetical sonic laboratory. One example is Astrovandalistas,

> a decentralised laboratory in different locations in Latin America, such as Mexico and Brazil as well as in the United States, developing low-tech tools that enable new forms of communication and collective participation with open software and open hardware that can be easily replicated (Aedo, in Bradbury and O’Hara, 2020, p.200)

Another example is MusicMakers Hacklab, “a week-long open, collaborative laboratory focused on the exploration of possible relationships between body and sound, hosted by Peter Kirn of CTM Berlin and Leslie Garcia/Paloma Lopez in Mexico City and Tijuana” (Aedo, in Bradbury and O’Hara, 2020, p.201).

A third example of a hackerspace dedicated to music, sound art, and sonic practices is MusicHackspace; it organises regular DIY workshops and events and is "a London-based community for innovators and hobbyists passionate about music technology and sound art" (MusicHackspace, n.d.).

Some of these examples are alternatives that exist outside the Eurocentric discourse. Their investigation would contribute to examining whether there is an alternative in laboratories located in decentralised areas that, through and using hacker practices, oppose capitalism.

The hacker approach to laboratory work, emphasising community, self-sufficiency, collaboration, and inclusion, and inspires an alternative position to some examples of laboratory models based on imposing and standardising hegemonies for profit (seen in science, academic and industrial labs through object quantification and profit versus knowledge sharing). Through my investigation of laboratories, I have discovered a similar drive towards community, inclusion and equity, also working in what I will term feminist labs. Feminist labs are places of inclusion and safety where female hackers and others gather to develop hacking practices. They contribute to a critical view of hegemonic, institutional, and mainstream laboratories and will be explored as an alternative/hybrid model in the following subsection.

1.6 Feminist Lab

The notion of a feminist lab emerges from US feminist, queer, and transhackers' work in hackerspaces. Feminist hackers, makers, and geeks started opening spaces that did not strictly follow the hackerspace model, as a different role model was required for feminists offering "safety [and] political resistance" (Toupin, 2014, p.1). They aimed to unite "hacker and feminist culture" (ibid.). The origins of the feminist hackerspace can be found in feminist practices influenced by feminist theories and movements. These spaces represented "The women's liberation movement in the US" (ibid.) with events such as "women-only face-to-face discussions and meetings" (ibid.). Toupin says these spaces contribute to "emancipatory purposes – aiming to help women" (ibid.).

Examples of feminist labs or feminist hackerspaces are "Geek Feminism Wiki (2008) Blog (2009), as well as AdaCamp" (Van Ness, in Bogers and Chiappini, 2019, p.252), all dedicated to women's participation in open technology and culture. Other examples of this direction that influenced feminism in hacklabs are "female, queer, and POC hacktivists [such as] Mz* Baltazar's Lab and Miss Desponias (2009), Mothership HackerMoms (2011), and Liberating Ourselves Locally or LOL! (2012), as well as Seattle Attic, Double Union, Flux (all in 2013), and FemHack (2016)" (ibid.).

All these examples represent feminist labs emancipated from male-dominated laboratories and address issues such as exclusion, lack of diversity, imbalance, access, and non-human inclusion, which will be reviewed next in this section. Feminist labs directly address female issues, such as asymmetries and discrimination, but also aim to tackle specific challenges, such as gender-based bias in STEM fields. Feminist labs are integral to the new feminist

hacking culture and follow critical principles of resistance practices. At the root of feminist labs is the desire to co-create so-called “safe” spaces where well-being (care) is central. A feminist approach to the laboratory includes consideration of community, and incorporation of “collaborations with organisations [and] introducing activities seen as more ‘feminine’ or generally accessible for women [not] making [them] seem overly ‘girly’” (Lewis, 2015, p.13).

Historically, women have been excluded from traditional laboratories, as their participation has been repeatedly neglected. Through this research, I hope to show the feminist response to this exclusion. In this sense, my survey revealed to me the dominant definition of the laboratory as based on an all-male laboratory and the science and industrial model, which displays the “racist, sexist, and colonial past” (Livio and Emerson, in Bogers and Chiappini, 2019, p.287). The feminist perspective follows, as I will show, the feminist practices employed in laboratories, which can inspire inclusive behaviour in sonic laboratories.

According to Emerson and Livio, there is a lack of diversity of underrepresented demographics "in lab leadership, membership, and communities" (Livio and Emerson, in Bogers and Chiappini, 2019, p.288). They suggest that laboratories must include women's and feminist concerns to balance these communities and facilitate equity and inclusivity. This can be done by adding and restructuring "the way labs work" (Livio and Emerson, in Bogers and Chiappini, 2019, p.289). Changes in laboratories may facilitate a new laboratory structure based on ethics, representing all communities and achieving better results in production, promoting situated practices, and re-addressing societal imbalances.

According to Lewis, there is an "observed gender-imbalance in the users of organisations known as 'hackspaces' and 'makerspaces'" (Lewis, 2015, p.1). Lewis defines feminist hackerspaces as “spaces either exclusively for women or with an explicitly feminist agenda” (Lewis, 2015, p.7). Criticism of a white male-dominated laboratory grows through feminism, aiming to achieve "a more egalitarian community" (ibid.). Unconscious bias is a constant in hackerspaces, and females need to position themselves to adopt critical perspectives of the white male-dominated laboratory. They are still "male-dominated areas, [which] frequently suffer from a gender imbalance" (Lewis, 2015, p.6). This affects the inclusion of female hackers in hackerspaces and contributes to creating the feminist hackerspace.

The complex societal problems of laboratory imbalance are not only current but come from past events, therefore the: “history of labs is inseparable from the history of science, [as] science is a project with colonial origins” (Livio and Emerson, in Bogers and Chiappini, 2019, p.290), and so “writing alternative histories of labs” (ibid.) is required, including those

“marginalised [and] excluded in the scientific codification” (ibid.), because “‘scientific knowledge’ and historical approaches are incomplete” (Dickson, in Livio and Emerson, in Bogers and Chiappini, 2019, p.290).

Feminist labs, according to Donna Haraway, should practice principles of "partiality and not universality" (Haraway, in Emerson and Livio, in Bogers and Chiappini, 2019, p.291). Haraway's idea of "partiality and not universality" in the context of feminist labs suggests that these laboratories should embrace a situated and specific position, acknowledging the diversity of experiences and perspectives of individuals, particularly women, rather than attempting to establish a single universal view and knowledge. This approach recognises that different people have different experiences and challenges, and it seeks to highlight and address these diverse perspectives and how they contribute to the production of knowledge as an equally diverse notion rather than imposing a singular hegemonic knowledge view.

Access, as well as imbalance, is another problem caused by the lack of diversity in the laboratory environment. Access is complex, and imbalanced practices are recognised when analysing who can access it. Another detrimental aspect of laboratories is “privilege, especially in higher education” (ibid.). As Lewis states, there is a lack of representation of otherness in education, “a similar imbalance in the number of girls and women pursuing study and careers in STEM and computing subjects” (Lewis, 2015, p.1). Generally, those with access to laboratory environments are “employed by an institution of higher education” (ibid.), so privileged access to the laboratory, and these become “gendered, colonial and racial” (ibid.) spaces. According to Emerson and Livio, what is required is “to better welcome those potential participants. […] That is, lab members need to make sure that in thinking through lab access, they don’t simply capitulate to an iterative process that only takes into account who and what is already known” (Livio and Emerson, in Bogers and Chiappini, 2019, p.290).

Another issue in laboratories is non-human inclusion. According to Livio and Emmerson, “inclusion of diverse persons and perspectives” (ibid.) is required to build laboratory communities, where “counter-methods” (Livio and Emerson, in Bogers and Chiappini, 2019, p.291) can be practised through community access and participation. Feminist labs, as Livio and Emerson describe, must take up "more-than-human concerns" (Livio and Emerson, in Bogers and Chiappini, 2019, p.295), considering non-human living beings and community members in contrast to laboratories that emerged from scientific value systems that imposed worldviews. Thus, feminists' approach addresses neglected non-humans and considers the needs of our “non-human planetary cohabitants” (ibid.) in laboratories where humans, animals, and marginalised groups will become Earth's living beings treated ethically.

Through this research, I present insight into laboratories' issues of exclusion, lack of diversity, imbalance, access, and non-human inclusion, as well as the resulting establishment of feminist labs. From here on, I investigate whether and how feminist approaches can be considered anti-colonial and essential to an alternative, hybrid sonic laboratory. Feminist labs are inspired by "feminist ethics of care" (Isenhour and Reno, Livio and Emerson, in Bogers and Chiappini, 2019, p.296) and other social and political theories, which I analyse in the following subsection.

1.6.1 Feminist Theories

Feminist theory is embedded in a new hacking culture as US feminist hackerspaces adopt an intersectional feminist perspective. Toupin states, "Intersectionally-inflected feminist principles might inform a new breed of hackerspace" (Toupin, 2014, p.1). Intersectionally influenced feminist principles entail a mixture of diverse political and historical practices, such as intersectionality and feminism, which put both tendencies into a new direction, considering not only gender imbalances but also inequities in other identity variables such as social class and race.

Feminist theories based on intersectionality become significant and varied as "intersectionality highlights a desire to see the world from intersecting, pluralist perspectives, […] considering as many different experiences as possible" (Toupin, 2014, pp.4-5). Moreover, intersectional feminists claim their richness, openness, and plurality, as their theory is infused with different movements, races, genders, and workers, so it makes intersection plural and ambiguous, far from singularity and hierarchical social structures.

The feminist hackerspace has been established, produced and influenced by such feminist theory and principles of intersectional feminism, which address "the relationship and intersection between gender, sexual orientation, geographical location, ethnicity, class, among others" (Toupin, 2014, p.2).

Feminist theories constructed upon reframing Marxism are "feminist standpoint theories [that recuperate] the experiences of the working class" (Toupin, 2014, p.3). This, in particular, impacts the feminist hackerspace as they, for example, adopt DIY and open-source practices that allow members of these communities to access free and shared tools that do not belong to private corporations (which develop and promote private and expensive tools that create economic imbalances for the less-favoured economic classes).

Nash defines "Intersectionality, [as] the notion that subjectivity is constituted by mutually reinforcing vectors of race, gender, class, and sexuality, has emerged as the primary theoretical tool designed to combat (…) hierarchy, hegemony, and exclusivity" (Nash, in Toupin, 2014, p.5). According to Nash, intersectionality opposes hegemony and influences

feminist labs. If feminist labs adopt intersectionality, those could become an alternative/hybrid model and an example for the sonic laboratory. In the next section, I will explore feminist hackerspace methods, which adhere to feminist principles to challenge imbalances and other issues of non-access and exclusion.

1.6.2 Feminist Labs' Practices

A feminist lab would be friendly and welcoming through practices of "'skill sharing'" (Lewis, 2015, p.14), integrating and socialising with a "mixed-gendered team of staff and volunteers" (ibid.), promoting philanthropy, and working "with other charities and non-profit organisations" (ibid.). The feminist approach promoted by Lewis in female laboratories could contribute to creating an accessible, open, and inclusive laboratory, primarily addressing the gender imbalance.

Women hackers develop their own spaces, ascribing to the hacker culture of do-it-yourself and do-it-together, but criticising and questioning the adoption of the male ethical hacking model. What feminist hackers mostly do is to "hack the concept of the hackerspace - reshaping the meaning of hacking itself as a way to hack life in all its forms to (re)gain autonomy" (Toupin, 2014, p.15).

Feminist lab's practices entail organising "training workshops such as feminist encryption (femcrypts), cell phone jailbreaking, mutual aid computer support, and other thematic workshops of all kinds" (Toupin, in Sollfrank, 2020, p.20). These practices subscribe to technofeminism, which implies feminist resistance developing technology that stabilises autonomous infrastructures, "such as servers, discussion lists, and bots [as well as] software and hardware" (ibid.).

Examples of autonomous servers developed by feminist labs can be found on the *A Traversal Network Of Feminist Servers* (ATNOFS): "ATNOFS is a collaborative project formed around intersectional, feminist, ecological servers whose communities travelled between each other to share and extend their knowledges through live gatherings" (A Traversal Network of Feminist Servers, n.d., p.3). Another example is the feminist lab server located in Calafou, the *Anarchaserver*: "Anarchaserver is a feminist server which aim is to develop autonomous infrastructure on the Internet for feminists projects" (Anarchaserver, 2023).

Feminist hackers deploy infrastructures, such as autonomous servers, that are understood explicitly as situated technology because these are part of the community and are built from the inside. Autonomous servers do not ascribe to profit corporativism and escape from "efficiency, user-friendliness, scalability, and immediacy" (Toupin, in Sollfrank, 2020, p.27). Instead, autonomous servers, part of feminist hackerspaces, focus on community,

considering their “social reality” (Toupin, in Sollfrank, 2020, p.28), facilitating access, and exposing “insecurity” (ibid.).

Another point in the practices developed by feminist hackers is the contribution to knowledge and practice of resistance, and they do that by moving “away from technology and computer science […]. Their idea is, first of all, to hack the concept of hacking itself and thus attract the attention of all feminists who have little to do with hacking in the technical sense” (Toupin, in Sollfrank, 2020, p.22). This is a crucial point for this research, as criticising the monopoly of science in building knowledge may criticise the laboratory as a mainstream and hegemonic space which develops practices that transform society.

Feminist hacking practices include “working together, [developing] politics of visibility, the co-production of knowledge, solidarity and awareness of the materiality of technology” (Toupin, in Sollfrank, 2020, p.21).

Another feminist hacker practice is body hacking, which considers understanding gender and the human body as technologies as well as entities that can be hacked and transformed. It is in considering gender or the human body as technology makes hacking much more accessible by creating familiar entry points for feminists. Including body hacking as a collective practice in response to online and physical violence will connect feminist hackers and reflect on the “materiality of technology” (Toupin, in Sollfrank, 2020, p.25). This formulates a materialist perspective of technology that opposes “patriarchy and capitalist exploitation” (Toupin, in Sollfrank, 2020, p.26). Feminist hackers collaborate transnationally and collectively, promoting plurality in general. In doing so, their contribution to knowledge is based on situated practices that consider “different historical, socio-economic, cultural, geographical realities” (Toupin, in Sollfrank, 2020, p.30). Situated knowledge is a methodology in feminist theories developed by Haraway, but feminist hackers also align with media materialism when proposing a new materiality of technology.

Feminist hackers expose how the “digital infrastructures [result] from the exploitation of minerals in conflict zones to unacceptable working conditions in production facilities to waste management in the technology sector (for example, disposal or incineration of equipment in China or Ghana)” (Toupin, in Sollfrank, 2020, p.26). The materialist aspects that feminist hackers shed light on refer to a part of the “exploitation of natural resources” as the “intangible appearance of the digital age with its significant effects on all social spheres” (Toupin, in Sollfrank, 2020, p.31). According to Toupin, the feminist hackers promote an “awareness of the materiality of technology” (ibid.) and consciously criticise the “new digital spirit of capitalism embedded in the highly controlled and secret infrastructures of

algorithmic governmentality, mass surveillance, and the extraction of minerals and rare metals, essential to the existence of digital devices" (ibid.).

Through the section about feminist labs, I explore an alternative to the male-dominated laboratory. Feminist labs adhere to materialist practices, which develop a criticism of the planetary scale. As the blue planet undergoes transformation through industrialisation and globalism, it is essential to critically examine the applications of planetary technology. This will be further investigated in Chapter 5.

Feminist labs led by women and other communities inspire this research, which focuses on and investigates another collective: the artists. In the following, I study artists, institutions, and exhibitions as art laboratories in order to find examples that move away from laboratories that behave purely scientifically or exclude others and adopt artists' practices. My aim is to find examples that are non-hegemonically constituted laboratories that represent artists and sonic practices.

1.7 Art Laboratories: Artists, Institutions, and Exhibitions

In this section, I introduce and survey the role of the art laboratories, following Gooday's laboratory definition, which considers spaces dedicated to "experimental epistemology" (Gooday, 2008, p.785). He calls these "spaces that served to generate new practical understanding of the world" (ibid.). These could be museums, workshops, kitchens, and other spaces of domestic life. In this section, I introduce artists' laboratories, institutions and exhibitions.

In studying art laboratories, I researched the work of Milena Dragićević Šešić and Sanjin Dragojević, who have published *Arts Management in Turbulent Times*. Both authors have contributed to the publication of the book mentioned above in the cultural policy and management field. The authors identify arts and culture institutions such as "(libraries, museums, theatres, galleries, etc.), in all sectors (public, private, civil), on all levels (international, national, municipal, local institutions), and for different programming orientations (artistic, activist, production, service)" (Dragićević Šešić and Dragojević, 2005, p.201) and generate a series of recommendations and advise to develop "educational and training programs" (ibid.). Laboratory practice is observed in the study, as influential in changing and transforming organisations. As the authors state, "organisational development […] in arts organisations [is influenced by different] types of developmental philosophies [as, for example] the organisation that generates and discovers things: a laboratory" (Dragićević Šešić and Dragojević, 2005, p.147).

The authors define the laboratory as an innovation centre. "The 'laboratory' is an organisation that places innovation at the centre of its programme, either in its local

community or on an international scale. Such organisations are built on the principle of excellence in art production" (Dragićević Šešić and Dragojević, 2005, p.148), requiring “new approaches and novel forms in art production” (ibid.).

Dragićević Šešić and Dragojević’s tell us “truly innovative experiment with forms and methods of artistic expression help to achieve excellence; total quality management” (ibid.) and this is one of their strategies, along with others such as: “harmonisation with the professional standards of operation, securing accreditation rights, education and transfer of knowledge - as well as some strategies from the domain of strategic linkage, such as the internationalisation strategy and public engagement strategies” (ibid.). Examples of a laboratory organisation are “Pina Bausch […] Wuppertal Theatre in Germany” (ibid.) and “Tadeusz Kantor’s Cricoteka Theatre in Krakow” (ibid.). Those laboratory-type organisations’ vital element is that they function as an “open platform for artistic expression” (Dragićević Šešić and Dragojević, 2005, p.149). Dragićević Šešić and Dragojević suggest that “it helps secure a creatively stimulating atmosphere for artistic work and the successful completion of individual projects” (ibid.). This definition of laboratory organisations inspires this research to investigate art laboratories through art centres, festivals, exhibitions, and examples of sound artists.

Another laboratory-type organisation that exemplifies art laboratories is Hugh Davies' work at the Electronic Music Studio (EMS) at Goldsmiths, University of London, in 1968. Situated within academia, the EMS is one of the laboratories, not really named a laboratory, but it functions as such. Davies worked on self-built instruments. Thus, he could be considered a pioneer through his DIY practice in modifying "electronic sound apparatus in his early live electronic compositions (…), through the 'instrumental turn', represented by his first self-built instrument" (Mooney, 2017, p.1). Davies contributed through his sound art practice to defining the laboratory concept in artistic and academic environments. With his DIY approach, Davies contributed to teaching and learning in a more hands-on experience, applying learning by doing. Nowadays, these features are present in most medialabs and hacklabs, which did not exist when Davies started practising with his self-built instruments.

Moreover, to present more examples of art laboratories, there are examples of laboratories in art centres, such as Laboratorio de Investigación y Producción Musical in Argentina. There is also a tendency to fund laboratories inside art institutions such as BANFF, Canada, and Hangar, Barcelona. Still, these laboratories represent an autonomous economy that facilitates music-making and the making of sound devices in the institution.

Organisations such as hacklabs and medialabs represent art laboratories, as seen in the recently inaugurated Sound LAB in Laboral, Gijon, (Spain), the new media centre for

producing, disseminating, and exhibiting technological sonic art. Sound LAB is a space for experimentation in the various practices of contemporary sound art (Laboral, n.d.).

Another example of an organisation that developed as an art laboratory is the IRCAM LAB, part of IRCAM (Institute for Research and Coordination in Acoustics and Music), founded by Pierre Boulez in 1977 at the Centre Pompidou and the French Ministry of Culture. IRCAM is considered a laboratory because it is "one of the world's largest public research centres dedicated to both musical expression and scientific research." (IrcamLab, 2014-2024). "IRCAM was in its planning stages, with Pierre Boulez relying heavily on the groundwork they laid in designing his own laboratory of sound" (Moore, 2024, p.210). Moreover, IRCAM is where artistic practice collides with scientific and technological innovation. This mixture of science and art is a feature in some laboratories that develop through interdisciplinarity. "Boulez's vision of a 'general school or laboratory' where scientists and sound artists mixed and mingled had come to fruition, and once IRCAM got into a groove, it started pushing out a steady stream of compositions, papers, and software from its many scientific and artistic residents and collaborators" (Moore, 2024, p.225).

To complement this survey, I also investigated those exhibitions that adopted the laboratory as a practice for exhibiting. For example, Joasia Krysa presented *Erkki Kurenniemi (In 2048)* at Documenta 13, a curatorial hybrid between new media curating and sound art to display computer techniques, archival material, and original prototypes of Kurenniemi's handmade instruments. Joasia Krysa notes that "such labs can address new institutional opportunities in humanities to engage with practice-based knowledge creation and extend their mission to include tools, techniques, and a new curatorial scope" (Krysa, 2015).

Kurenniemi pioneered electronic music and computer arts and was an experimental filmmaker, inventor, archivist, and futurologist with numerous disciplinary boundaries “from the aesthetic to the scientific and technical” (Egbe, n.d.). The exhibition combined media archaeology, museology, computer arts, electronic music, curating, art history, and all those concerned with storing and retrieving knowledge.

Moreover, Kurenniemi is a key example of practising art laboratories that use sound and other artistic disciplines, as he represents ways of conducting “laboratory experiments” (Krysa and Parikka, 2015, p.144). In Krysa’s words:

> The future unfolds through an inventive spirit infused with engineering and science. The experiments started already in the 1960s at the Department of Musicology in Helsinki with access to the studio and tape edit and montage possibilities: “demo materials on tapes and then combined them live without a prerecorded montage,

> using my legs to flip different dials and switches and turning the tape reels back and forth with my hands". (ibid.)

Kurenniemi is also present in curatorial projects, as he was included as part of Documenta 13 in Kassel in 2012. Krysa, the curator, explains:

> Entitled simply *In 2048* it was the first large international presentation of his work including his pioneering music instruments, such as his DIMI series of electronic synthesizers and electronic music compositions; robots; generative computer animations; short films; and his writings on music theory, computer programs, and his personal diaries recorded in all kinds of formats — audio tapes, video tapes, handwritten texts and those processed by computers (Krysa and Parikka, 2015, p.xix)

Krysa heads the development of the Exhibition Research Lab (ERL), a public space and research hub focused on the interdisciplinary exploration of exhibitions and curatorial knowledge. ERL approaches curatorial practice as a means of critical inquiry and knowledge creation. It reimagines the conventional role of an art gallery—not just as a venue for display or an educational resource—but as an expansive 'lab' where experimental ideas and practices unfold and curatorial knowledge is actively generated, enacted, and shared with the public.

This curatorial practice based on the laboratory could inspire what I name *exhibition lab*, a possible curatorial method applied, for instance, in Zenovia Toloudi's exhibition "Metamaquettes: Between the Lab and the Site" (Holwerda, 2019). This model has been theoretically "developed [as] a pedagogical model that is based on exhibitions and art installations which [Toloudi] had used and tested as part of [her] Thesis Lab course" (Toloudi, 2016, p.273). I would think of this model in further research.

Conclusion

Creating this survey, I recognise that the wide diversity of laboratories makes it impossible to generalise and find on definition of what a laboratory is. I have confirmation of this finding in Jussi Parikka's words:

> The "inventing the future" sort of corporate brand of MIT Media Lab differs rather radically from these small-scale examples that could be even called humanities labs of our era, and they differ from the emergence of labs in rather different geopolitical locations such as the maker-lab ecosystems emerging in West Africa, for example in Agbogbloshie, Ghana, one of the hubs of e-waste dumping. (Parikka, 2016)

Therefore, this survey does not mean to represent a comprehensive list of possible definitions but instead examines different laboratory typologies, including academic,

science, medialabs, hacklabs, and others, to understand their specificities, characteristics and behaviours to highlight which laboratories' qualities can contribute to identifying the sonic laboratory.

However, the survey encounters a problem with mainstream laboratories concerning hegemony and universality. The survey clearly shows (see Chapter 1, section 1.2) the relationship between academic labs and industrialism-capitalism through the example of the American University, which could perpetuate the suggestion of a hegemonic laboratory model. Those that operate as mainstream laboratories follow values such as “entrepreneurialism" (Wershler, Emerson, Parikka, 2021, p.156), wanting profit and allying with the military and governments and to disseminate hegemonically as an imposition model through the American universities/academic labs system.

By contrast, I have found that digital humanities laboratories (DH labs) are considered alternatives to mainstream laboratories (see Chapter 1, section 1.2). DH labs are developed through “humanities infrastructure” (Wershler, Emerson, Parikka, 2021, p.82), which integrates a “network of scholars, practices, institutions, epistemologies, ideologies, and cultures of STEM, the Humanities, higher education, and society” (Malazita, Teboul, Rafeh, 2020) representing an alternative model to generating knowledge in laboratories and institutions.

As my survey shows, another way to produce alternatives to mainstream laboratories is by adopting feminist theories. Feminism opposes a science model that is “racist, sexist, and colonial” (Livio and Emerson, in Bogers and Chiappini, 2019, p.287). As I show, feminist lab spaces offer “‘skill sharing’” (Lewis, 2015, p.14) and collective support. Furthermore, Nash suggests that feminism grounded in intersectionality is created to challenge structures of “hierarchy, hegemony, and exclusivity” (Nash, in Toupin, 2014, p.5). Here, I have encountered an opposition from feminism to hegemony. Feminists oppose colonial science, hence becoming an anti-colonial proposal. In other words, “feminists propose anti-colonial approaches” (Livio and Emerson, in Bogers and Chiappini, 2019, p.295). Moreover, feminist labs apply “counter-methods” (Livio and Emerson, in Bogers and Chiappini, 2019, p.291), which resemble Latour's definition of “counter-laboratories” (Latour, 1987, p.79) used to defy imposing laboratory practices.

Furthermore, my findings suggest that examples such as Bell Labs and Edison Laboratory could be models for twentieth-century laboratories that entail an “all-male industrial research laboratory" (Livio and Emerson, in Bogers and Chiappini, 2019, p.288). Opposing this, I will use feminist labs to propose an investigation around the sonic laboratory’s potential, which finds in the Edison Laboratory an originator of the concept of a sonic laboratory. As

Paul Israel suggests, “West Orange […] became a sonic laboratory as they experimented with recording” (Israel, 2020).

Another reference for the sonic laboratory is the MIT Media Lab’s Experimental Music Studio. The controversies around the MIT Media Lab will distance me from this example, as it represents “part of the lineage of private-sector technology labs” (Wershler, Emerson, Parikka, 2021, p.61), which could represent a hegemonic type of laboratory.

Additionally, I have presented examples of existing medialabs and hacklabs as interdisciplinary laboratories that develop sonic practices as “decentralised laborator[ies]” (Aedo, in Bradbury and O’Hara, 2020, p.200) and thus have the potential to represent sonic laboratories not located in the Eurocentric region. Examples are Astrovandalistas and MusicMakers Hacklab (see Chapter 1, section 1.5).

Moreover, I have encountered evidence of organisations that behave as art laboratories (such as Hugh Davies’ Electronic Music Studio, London, Sound LAB at Laboral, Gijon, Spain, and IRCAM, Paris). These organisations apply art practices and curate exhibitions, which will be explored in the following chapters, which are dedicated to laboratory methods, curating laboratories, and field recording.

Through this chapter, I have found that DH Labs promote an alternative way to access and produce knowledge. While the American university labs stand for a hegemonic example, they capitalise on knowledge production mediated by the alliance of industry, military, and science. A model that spread and promoted the standardisation of American universities. Similarly, pharmaceutical labs aligned with industrial behaviour and resembling modern technoscience and large corporations help to identify hegemonic models of laboratories. Critically opposing, Klein suggests an ethical model for laboratories. In Chapter 1, I encounter Latour's definition of counter-laboratories, which are laboratories that defy conventional industrial and finance-based labs. This definition influences my research to opt for hybrid and alternative models that inspire the sonic lab. Continuing, I found a positive example in artsciencelabs, which promotes interdisciplinary research and not imposing paradigms, through collaborative and not only science-based research. I have also found that although industrial labs may be the origin of sonic labs through developing sound reproduction technologies, I have demonstrated that their profit and business-centred model (for example, Bell Labs and Thomas Edison Laboratory) will influence subsequent laboratories such as medialabs. Contrary to this, hacklabs and hackerspaces operate collaboratively and collectively thanks to open-source. Similarly, makerspaces appear to be open and mediated by generosity. I also found that, following Aedo, there are decentralised and collaborative sonic labs. Moreover, the feminist labs address exclusion, lack of diversity,

imbalance, access and non-human inclusion in labs. They are based in the community and through collaboration. The feminist labs are conscious that the history of labs is the history of science, and this is a colonial project based on scientific codification and others' exclusion. In front of these, Haraway proposes the principle of partiality opposed to the universality. Diversity is also a recurrent feature in feminist labs. I have also found evidence of hegemony's definition in Nash, who states that intersectionality is used to combat hegemony, hierarchy, and exclusivity. Finally, I understood that feminist practices are practices of sharing.

From these, I can conclude that laboratories are varied and plural, with some of them identifying with hegemonic practices and others opposing through alternative, critical, ethical, interdisciplinary, collaborative, collective, open, generous, decentralised, sharing, and community spaces, which may represent what the thesis aims to find in sonic laboratories.

Chapter 1 presents a literature review that provides an overview of laboratory types, from antecedents to contemporary examples. By analysing laboratory types, such as academic and artscience labs (the latter explored by Edwards), I have found that sonic labs already exist in the form of sonic academic labs and artists' residences within science laboratory types that produce sonic-centric outcomes. These two examples of existing sonic lab types are selected for further development in Chapter 2.

In conclusion, this survey chapter lays the foundation for this thesis's aims and objectives: to explore sonic laboratory potential and reach a non-hegemonic and critical perspective through feminist theories and anti-colonial practices. While "sonic laboratory" has been used in academic and artscience labs, it remains relatively unexplored. In Chapter 2, I will present various sound artists in artscience labs and academic labs dedicated to sonic technologies and sound art. This analysis will be essential in exploring the potential inherent in the sonic laboratory.

2. Sonic Practices in Laboratory Environments

Introduction

In Chapter 2, I present the case studies as a method in this research, organised into two sections: the artists' residences in the science labs (artscience labs) and the academic sonic labs. The first section presents four examples selected from Scott's *Artists-in-Labs* and Edwards's definition of artscience labs, as presented in Chapter 1. The selected artists are Robertina Šebjanič, Luca Forcucci, Pe Lang, and Ryoji Ikeda. For the second section, sonic academic labs, I present four examples: Sonic Lab UVic, Laboratorios Sonoros, Sonics Immersive Media Labs, and The Sonic Laboratory. Analysing sonic artists in laboratories provides me with the methods (e.g., field recording and prototyping) and outcomes (e.g., sound-centric components and curating) employed in laboratories to examine what constitutes a sonic lab. By studying academic sonic labs, I encounter different approaches to sound, including aesthetic and curatorial promotion, a critical enquiry into technology, and a sensorial and interdisciplinary approach. This enables me to further develop my thesis by examining the findings of this chapter in the next chapters: laboratory methods (Chapter 3), curating (Chapter 4), and field recording (Chapter 5).

In the previous chapter, I produced a historical and contemporary survey of laboratory types, demonstrating that the practice of sonic laboratories already exists but is less recognised than the medialab. In response, Chapter 2 focuses on examples of artists working in laboratory contexts and aims to achieve recognition of the sonic laboratory as a practice that studies, investigates and develops the critical potential of the laboratory through sound practices. It is divided into two sections:

- One explores artists in science labs through residences.

- The other focuses on sonic laboratories in academic environments.

The first section shows sonic art practices that have been developed in scientific laboratory environments. I discuss four examples of artists developing sonic works in science labs: Robertina Šebjanič, Luca Forcucci, Pe Lang, and Ryoji Ikeda. The contribution of these relations between artists and science labs to this research is paramount, and analysing their methods and outcomes will help to critically explore the sonic laboratory's possibilities.

Exploring the potential of sonic laboratories in the context of this thesis will allow me to articulate how and why they are different from mainstream laboratories and how they operate differently, contributing critically to knowledge and social and cultural development. Through experimental methods, sonic laboratories can hypothetically achieve better results through collaboration and exchange, as seen in the cooperation between artists and science

labs, which could exemplify sonic laboratory practices. Examples of collaboration between artists in science labs are relevant to this research because they enable artists to contribute to laboratory practices. That makes it interdisciplinary and may enrich the sonic practices.

In this chapter, I study artists working in science labs and identify them as a location of sonic practice. To do so, I present four artists developing sonic practices in the laboratory environment. The relationships between artists and science labs have already been explored in Chapter 1, particularly in the Science Labs section: the connection between art and science is a phenomenon that can also be observed in "artscience labs" (Edwards, 2010, p.8). The name artscience lab refers to artists working in scientific places such as laboratories developed through residency programs, generally funded through government grants. By looking at the relations between science labs and art practices, I create an overview of the relationship between art and science in a laboratory environment, focusing on sonic practices.

Subsequently, I study several laboratories in academic institutions that develop sonic practices. Although the sonic laboratory does exist, I contend that it has not yet been explored and articulated deeply enough to gain recognition. Therefore, I study academic laboratories that develop sonic practices to understand how the sonic laboratory identifies with experimental, alternative, and critical practices.

The sonic laboratory may oppose an institutional laboratory: a model that hegemonically imposes a standard view of the academic lab related to the military and industry, such as the American university model (in Chapter 1, Academic Labs section). This research will then elaborate on how the sonic laboratory critically challenges this model.

The four examples of academic laboratories I have chosen to study are Sonic Lab UVic (University of Victoria), Laboratorios Sonoros (Musica UNAM, Mexico), Sonics Immersive Media Lab (SIML, Goldsmiths, University of London), and The Sonic Laboratory (Sonic Arts Research Centre—SARC, Queen's University of Belfast).

I examine how academic laboratories employ sonic practices and identify them as contributing to or defying the hegemonies of normative laboratory practices. The term hegemony in this context is read through the definition of specific American university labs, as seen in Chapter 1, as a standard academic lab model where certain practices dominate, and may impose views and establish certain paradigms on culture and societal development.

The term sonic laboratory is quite common throughout academia; however, it is my contention that it requires further elaboration to gain recognition. This chapter introduces different laboratory examples focusing on sonic practices to stage such an exploration and achieve the subsequent recognition of the term. Although some of the laboratories

investigated here already use the name sonic laboratory, studying their practices and outcomes is essential for this research to highlight the sonic laboratory's particular features and possibilities.

Analysing these sonic laboratories and exploring their methods will help me further develop Chapter 3.

2.1 Sonic Practices in Science Labs

The participation of artists in science labs is mentioned in this thesis, specifically in the definition of Science Labs in Chapter 1. Following Edwards, the collaborations in a government-type residence-funded laboratory are called artscience labs. The examples I present in this section about artscience labs will focus on sonic interventions. I will present four examples of artists developing sonic works in a science lab environment. I will primarily highlight the qualities of sonic practices in these environments, as I aim to understand how sonic practices transform and enhance science labs beyond industrial standards, and improve practices through interdisciplinary collaboration, inclusivity, openness, and complexity, thereby becoming sonic laboratories.

2.1.1 Robertina Šebjanič at the Marine Institute Ireland

Robertina Šebjanič is an intermedia artist based in Ljubljana. She is an active participant at the Hackteria laboratory. Among other laboratories in which she participated, there are "Interactivos'12 Ljubljana: Obsolete Technologies of the Future at LJUDMILA digital media lab in Ljubljana (…), KSEVT – Cultural Centre of European Space Technologies (…), HackteriaLab Bangalore and (…) HackteriaLab Yogyakarta." (Hackteria, 2015).

Šebjanič has recently participated in *Aerial/Sparks*, an exhibition from her residency at the Marine Institute Ireland.

The Marine Institute Ireland is a "State agency responsible for marine research, technology development and innovation in Ireland" (Marine Institute, 2022). It is a laboratory where marine acoustics is researched, and the RV Celtic Explorer is among their facilities. The RV Celtic Explorer is "Acoustically silent (ICES 209), which minimises fish avoidance and provides an ideal environment for the collection of high-quality acoustic data" (ibid.). Other features are "Dynamic positioning" (ibid.), "acoustic transducers and other instrumentation" (ibid.), and "Large dry and wet laboratories" (ibid.).

The artwork produced by Šebjanič during her residence at the laboratory was shown at the *Aerial/Sparks* exhibition curated by Louise Manifold. *Aerial/Sparks* will be analysed in depth in Chapter 4, Curating as a Laboratory Practice, in the section Curating Artists-in-Laboratory Residences.

In this group show context, Šebjanič presented her sound art project *Selachophilia: Cetorhinus Maximus - Limaria Hians*. The artwork weaves together mythologies and sciences, humans and non-humans, to speak of our ability to address challenges in the age of the Anthropocene. Stories unfold carried by the migratory Basking Shark (Cetorhinus maximus) and the flame shell (limaria hians), a small species endemic to the North Atlantic waters. Šebjanič had the opportunity to experience both sea creatures during her residency on the RV Celtic Explorer. This immersive audio installation intertwines *sean-nós*[2] vocals with the narration of a storyteller and field recordings above and below the depths of the Atlantic Ocean. (ibid.)

In Šebjanič's words, she produces sound works that result from the intersection of art, science and technology, and such interference between fields creates a hybrid media (Šebjanič, n.d.). Her methods are essentially field recording and developing narratives, which intrinsically belong to sound or sound art. Both practices can show and contribute to an alternative laboratory. According to Stirling, "Field recording as a method (…) revealed sound's potential to impart alternative or additive knowledges about the urban social world and its musical and sonic environments" (Stirling, in Bull and Cobussen, 2021, p.130). Šebjanič uses field recording as a method in the laboratory residency. This will be of high importance for my research, as I will later, specifically in Chapter 5, Field Recording and the "Planetary Laboratory", identify field recording as a practice embedded in a planetary environment that considers ethics and consciousness through sound and technology. As defined by Féraud:

> Field recording is not only justified by the fact that we are interested in sound, it is not only a 'sampling' tool. It constitutes the methodological pivot of sonic anthropology […] because it allows, by considering the positioning of the sound recordist, to reflect the relationships that are established in a sonic dimension between individuals in their environment. (Féraud, in Bull and Cobussen, 2021, p.770)

Another method in Šebjanič's residency on board the RV Celtic Explorer was the use of the vessel's sonic tools and other techniques, as mentioned above, such as "acoustic transducers and other instrumentation" (Marine Institute, 2022), with which the artist had the chance to investigate interactions between organisms and sediments from a scientist's perspective. The result was a sound installation with a sound-centric component, as described below.

[2] *sean-nós* is an unaccompanied Irish singing style characterised by its melodic ornamentation.

Her work as a sound artist who, after 15 days on the boat, produced a sound work, an audio installation, presents *sean-nós* vocals with the narration of a storyteller and field recordings of the Atlantic Ocean. The artist is interested in the relationship humans have with sharks. From an ecological perspective, the inter-species connection between huge and small creatures (sharks and shells) produces an interaction affecting the environment (Šebjanič, n.d.). The artist includes the anthropocentric perspective in the sound work through the recourse of the voice, and in doing so, she explores how sharks are connected to folklore, questioning how science through sound can learn from folklore (ibid.).

Resuming, Šebjanič's tools and objects consist of the following:

- Technologically sound apparatuses from the laboratory.
- Humans and non-humans' narratives and vocals.
- Field recording.

And Šebjanič's outcome is:

- A sound installation in an exhibition.

Both outcomes illustrate the development of sonic art practices in laboratories. Such curatorial development is something that artscience labs do, as Edwards demonstrates and as defined in Chapter 1, Science Labs section: "through a cultural exhibition, artscience labs provide a medium of public dialog that is both analogous to, and an alternative to, the medium of peer-reviewed publication in traditional science labs" (Edwards, 2010, p.173). Chapter 4 (Curating as a Laboratory Practice) will further investigate whether curatorial practices in laboratory environments can turn laboratories into hybrid and alternative spaces, generating knowledge and experiences rather than following the manner of institutional laboratories.

2.1.2 Luca Forcucci at the Brain Mind Institute (BMI)

Luca Forcucci is another example of an artist in a science lab. At the Brain Mind Institute (BMI), Forcucci "is interested in perception, subjectivity, and consciousness" (Forcucci, n.d.) and is influenced by "the late American avant-garde composer and musician Pauline Oliveros, and her concept of deep listening expanded to all what is humanly possible to listen" (ibid.).

At the Brain Mind Institute in Switzerland, where "three labs were interested in his work: The Laboratory of Neuroenergetics and Cellular Dynamics (LNDC), The Digital Holographic Microscope Group (DHM) and the Laboratory of Cognitive Neuroscience

(LNCO)" (Scott, 2010, p.151), Forcucci explored cognitive neuroscience of out-of-body experiences.

As part of his residence at the laboratory, the artist developed the *Music for Brain Waves* project, which consists of creating a sound work which “experiments with online scalp recordings of the brain’s electrical activity (EEG) and converts these measurements into a musical score or soundscape” (Scott, 2010, p.106).

The inspiration for the project comes from the work *Solo Performer* by Alvin Lucier. Lucier's piece for percussion uses equipment to detect alpha waves. He sits on stage with electrodes on his head: "The brainwaves are constantly picked up with the electrodes and amplified with a brain wave amplifier. A filter allows only the alpha waves to pass through. Then, the signal is split into several channels, and each channel is amplified and routed to a loudspeaker. The cones of the speakers follow the alpha rhythm and make percussion instruments sound, either by hitting them directly or by the motion of the air. One or two assistants control the volume of the individual channels and, in doing so, determine the musical shape of the piece" (Lucier, n.d.). Lucier's piece is relevant and influences Forcucci as both use brain wave detectors to create a sound work.

Forcucci's methods consist of recording "EEG signals (electroencephalographs) through a software program called Matlab and a hardware device called Bio Semi" (Scott, 2010, p.151). Moreover, Forcucci "asked for several videos from the holographic microscope as material for [his] compositions" (Scott, 2010, p.152). Forcucci decided he "could possibly transfer their images of stimulated neurons into sound" (ibid.). Thus, he uses Max/MSP[3], and as a result, a sound work represents an outcome of Forcucci’s residence in the laboratory at the Brain Mind Institute.

Resuming, Forcucci’s methods consist of making use of:

- Hardware called Bio Semi.
- Software called Matlab.
- Max/MSP for composition.

As an outcome, Forcucci presented "a sound installation based on the idea of the auditory perception where internal and external spaces could be audible at the same time" (Scott, 2010, p.152). According to Forcucci, "The exhibition idea resulted in a further research project that would attempt to cross the boundaries of architecture, neuroscience, and sound from a transdisciplinary approach" (ibid.). Forcucci explains that *Music for Brain Waves*'

[3] Max/MSP is a creative software application for sound that allows artists to express themselves creatively by manipulating their input data.

principal outcome was "to compose new sound compositions" (ibid.). The project culminated with an exhibition at Barbara and Art Culver Center of the Arts, Riverside, California, in May 2011, and at the Department of Fine Arts, the University of the State of Sao Paulo, in October 2012.

Forcucci's primary outcome is based on composers and sound artists such as Pauline Oliveros and Alvin Lucier, and is also influenced by scientists in the laboratory. According to the artist, "The project would cross the boundaries of the labs by working on a multidisciplinary approach" (Scott, 2010, p.152). Indeed, Forcucci's work is interdisciplinary, using artistic, sound art and scientific disciplines. Interdisciplinary research characterises these residency-shaped laboratories, and Forcucci's work with sound practice will help understand how a sonic laboratory might be understood and developed. Forcucci's project outcomes are:

- exhibiting a sound installation
- creating new compositions.

Both outcomes represent the use of sonic practices and techniques to develop works in the laboratory environment. Sound installations are characteristic of sonic practices and are defined as follows: "Sound installations may be site-specific or not […]; they may include performance, recording, or broadcasting elements; they may be installed across multiple spaces and times […] (or) installed in galleries, museums, electronic networks, and in myriad non-traditional spaces. (Ouzounian 2008: 33)" (Lacey, in Bull and Cobussen, 2021, p.315).

Moreover, coinciding with Šebjanič's practices, among Forcucci's outcomes, there is the exhibiting component. It represents a method that contributes to showing the research process results and exploring the potential of sound works developed in laboratories. The aesthetic dimension of curatorial practices is present in artscience labs, seen in Chapter 1, as an outcome of the research process serving as an exhibition making which incurs in what Edwards defends as the construction of public knowledge: "exhibition[s] invited the public into an exploration of the lab as a 'knowledge generation institution'" (Edwards, 2010, p.26).

Following on from this, my investigation will explore curatorial practices' contributions to the definition of the sonic laboratory. This aspect is essential for understanding the sonic laboratory's possibilities and how exhibiting can help define it. Therefore, the following chapters, specifically Chapter 4, will analyse curating as a laboratory practice.

2.1.3 Pe Lang at the Swiss Center for Electronics and Microtechnology (CSEM)

The artist Pe Lang is working in a science lab to configure it as an artscience lab that develops sonic works and represents an example of the sonic laboratory. I am considering his residency at the Swiss Center for Electronics and Microtechnology (CSEM), where he received a one-year research residency fellowship in 2007. According to Langs' biographical note, he is

> a Swiss-born artist known for creating minimal kinetic artworks that control and put physical forces into action with a captivating elegance. His sculptures and installations combine handmade mechanised systems with a stringent constructive optimisation in which each element can be deciphered concerning its functionality. (…) he began by creating experimental mechanical sound objects (Lang, n.d.)

At the CSEM, Lang developed the *Untitled Sound Project*, which mixes different disciplines such as sound art and electronics. According to Scott, the artwork aims at "Analysing a room's attributes using acoustic analysis. Compiling new micro- and macrostructures in compositions based on the idea that the 'syntax' of music and/or composition is manipulated by an external system" (Scott, 2010, p.174). Lang was researching "Learning from new technologies and reinterpreting scientific phenomenon in an artistic manner" (ibid.).

Lang explored the artistic possibilities a science lab brings, as identified in artscience labs: "a protracted period of cooperation with scientists and engineers" (ibid.). Lang spent three months learning about the "CSEM projects and departments" (ibid.). According to Lang, the CSEM "works at the interface of research and industry" (ibid.).

Lang defines himself as "an art autodidact" (ibid.) and, during his residency at CSEM was creating a "project plan and learning UML2 (Unified Modelling Language), a standardised language for modelling software and other systems" (ibid.) with which he develops his art project by collaborating with more than thirty-five scientists working at the laboratory. He characterises his works as a mix of art, sound art, and science. He is interested in technology and knows electronics. These factors contributed to productive communication and the exchange of ideas with the scientists in the lab.

Lang's artistic plan stipulated that he "had to decide on a specific project within the first three months" (Scott, 2010, p.176), and Lang's artistic method "was to make a prototype early on in the process" (ibid.). Moreover, Lang "studied and experimented with a 3D camera, and with a delta robot and various applications, as well as with a number of innovative sensors and wireless networks" (ibid.). Lang explains the process of creating his project:

> I began to work on the software for acoustic analysis but soon realised that the time did not allow for both aspects. So, I adapted the focus of my original submission—an intelligent acoustic composition system—to an output system consisting of 8 turntable computer-controlled loudspeakers (ibid.)

After the ideation process, Lang continued constructing the work:

> I learned a lot from Thomas Bruch about motors, drives, encoders, and amplifiers. I had to examine the specification of motors and accessories to ensure that they fulfilled the various requirements for power, running speed, and precision. The gearing had to meet specific dynamic parameters, and the whole assembly should run as silently as possible (ibid.).

To accomplish these conditions, Lang met "Mr. Schallibaum of Maxon Motor, which had built the motors for the 'Sojourner' Mars rover" (Scott, 2010, p.177) and "started to redesign the project" (ibid.).

When all the components arrived, Lang started to build the project. "The plan was to have all 8 loudspeakers working by 28 November" (Scott, 2010, p.178). In addition to the loudspeakers, Lang completed "a brief composition and choreography for the demonstration" (ibid.). He also "developed the control algorithm for the motors to turn the speakers" (ibid.).

In short, Lang started by questioning how the artists' works could influence scientists but concluded that "there was certainly an exchange of ideas" (ibid.). The residency at CSEM brought Lang "new ideas and allowed [him] to transcend [his] own boundaries" (ibid.).

Lang's methods are characterised by the following:

- Hardware, such as motors and sensors.
- Control algorithm.

Lang's residence outcomes are:

- the prototyping of loudspeakers,
- a brief composition
- a choreography.

I highlight here that these three aspects are sound-centric and contribute to understanding sonic laboratories as places dedicated to sound through sonic practices and outcomes.

Lang's ideation of a loudspeaker prototype is one of the defining features of artscience labs in the creative process, from ideation to prototyping, as observed in Chapter 1. As defined by Edwards,

> rapid prototyping […] and translation of ideas into products or processes with beneficial social impact […] play a fundamental role in our concept of 'idea translation.' Perhaps the most distinctive characteristic of artscience labs is that education, cultural exhibition, and production are all simultaneously core values" (Edwards, 2010, p.23).

In the context of this thesis, this case study serves as an illustrative example of how the processes of ideation and prototyping shape this research's question concerning the potential of the sonic laboratory. Furthermore, prototyping will be examined in greater detail in subsequent chapters, specifically Chapter 3.

As demonstrated in Lang's work, incorporating music composition within the laboratory aligns with the earlier examples of Šebjanič and Forcucci, highlighting the appropriation of arts and critique with sound and humanities within a scientific environment. This responds to my research question about exploring the potential of the sonic laboratory through transgressing scientific norms with sonic approaches.

Although the project intersects with scientific research, appropriates industrial models, and employs hardware and algorithms (techniques used by engineers and computer scientists), the results focus on sonic practices. This, I contend, makes it a good example for examining and ultimately establishing sonic practices in science labs. Like Šebjanič and Forcucci, Lang also applies methods appropriated from science. Lang's work is defined by the relationships with engineers and the laboratories' connections through industry research. Using scientific tools to produce sound work represents a critical aspect of a sonic laboratory. However, this research must establish how the conditions are created to generate open, hybrid, and inclusive practices in the sonic laboratory that can ensure the cross-fertility between sound, art, technology, and science.

2.1.4 Ryoji Ikeda at the Prix Ars Electronica Collide @ CERN 2014

Ryoji Ikeda is the award winner of the Prix Ars Electronica Collide @ CERN 2014. He is an electronic composer and visual artist "who creates moving-image, sculptural, sound and new media works" (Ars Electronica, n.d.). He "has a reputation as one of the few international artists working across visual and sonic media. He elaborately orchestrates sound, visuals, materials, physical phenomena, and mathematical notions into immersive live performances and installations" (CERN, 2014). Ikeda is "Japan's leading electronic composer and visual artist" (Arts CERN, n.d.) who "focuses on the essential characteristics of sound itself and that of visuals as light by means of both mathematical precision and mathematical aesthetics" (ibid.).

The Prix Ars Electronica Collide @ CERN 2014 is a residency program between Ars Electronica Future Lab and CERN. The program benefits an artist selected, in this case, Ikeda, "to see how CERN's science and technology influence the direction of his work for years to come" (Ars Electronica, n.d.). Ikeda "sees CERN's processing and analysis of data as a source of inspiration" (ibid.) and continues, "The residency at CERN and Ars Electronica Future Lab gives me the extremely valuable freedom of time and space to research and explore new areas at CERN - one of the world's leading centres of technology - without any pressure, which is something I have been longing for" (ibid.).

CERN (Conseil Européen pour la Recherche Nucléaire) is the world's leading laboratory for particle physics. Its research involves physicists seeking answers using some of the world's most powerful particle accelerators.

> CERN hosts the Large Hadron Collider (LHC). It is the world's largest and most powerful particle accelerator. It first started up on 10 September 2008 and remains the latest addition to CERN's accelerator complex. The LHC consists of a 27-kilometer ring of superconducting magnets with a number of accelerating structures to boost the energy of the particles along the way. The beams inside the LHC are made to collide at four locations around the accelerator ring, corresponding to the positions of four particle detectors – ATLAS, CMS, ALICE, and LHCb. (CERN, n.d.)

The Prix Ars Electronica Collide @ CERN 2014 residency, in which Ikeda participated, consisted of a collaboration with the Science Inspiration Partner and theoretical physicist Tom Melia. During the residency, Ikeda had the opportunity to register, hear, and see the LHC and deal with a vast amount of data supported by a team of programmers that helped him to develop an artwork featuring some of Ikeda's well-known themes (installations that go from the nanoscale to 15 km). The CERN residency program offers artists time and space to have access to deep thinking, and the close collaboration with scientists can also serve as an inspiration. Highlighting CERN's interdisciplinary approach as one of the most outstanding research facilities and international corporations, CERN is a role model that develops through international collaboration between members, observers, and scientists from diverse nations.

Continuing with Ikeda’s experience at CERN,

> The residency provides artists with time and space to reflect, research, and renew their artistic practice. Ikeda did this by deeply exploring CERN science's multidimensional work through meetings with physicists, including experts on extra dimensions and supersymmetry. He even met with the man in charge of the LHC

> himself, Frédérick Bordry, and Sergio Bertolucci, Director of Research and Computing. Ikeda finished his residency at CERN after a two-week stay on campus in January 2015 (...). The artist has attributed his time at CERN as a source for creating two pieces: 'supersymmetry' and 'micro | macro' (Arts CERN, n.d.)

Ikeda's artist-in-lab residence at CERN exemplifies interdisciplinary work through sound, visuals, science, technology, mathematics, and particle physics. Moreover, Ikeda's sonic practices include the use of:

- Hardware.
- Software/Programming.
- Data.
- Composition.

Ikeda's sonic practice is similar to that of Forcucci and Lang. All these artists use hardware and software in their laboratories to create musical compositions. Their music composition contributes to science and technology, allowing me to define a laboratory through a different perspective, not just as a science-based laboratory. Ikeda's outcomes also coincide with previous examples of sound installations in an exhibition environment. To continue this research, in Chapter 4, I will study curating as a laboratory practice related to laboratories.

Next, I need to research academic labs that focus on the practice of sound, whether it is aesthetically or technically engaging. The research on sonic academic labs will provide examples of laboratories that already exist and that work with sound in different and wider approaches.

2.2 Sound in Academic Labs

There is a long tradition of historic sonic laboratories in academic environments. As cited in Chapter 1, IRCAM can represent an institutional laboratory originally dedicated to sound exploration; hence, it is an example that can be used to claim recognition of sonic laboratories. In the history of academic labs dedicated to sound, there is a notable difference between the American and European models, exemplified by the IRCAM model versus the Stanford model. The IRCAM model would be an institutional government place dedicated to sound, science, technology, and music. The Stanford model exemplifies the American University model, which shapes the Academic lab, as previously referenced in Chapter 1. This model has been fused with the military and industry during its existence and is involved in industrial profit.

Continuing such comparisons, in the next section, I will explore four cases of contemporary examples of sonic laboratories in academic environments that differ from one another and offer different methods and practices.

2.2.1 Sonic Lab UVic (University of Victoria)

The Sonic Lab at UVic "is directed by Ajtony Csaba" (University of Victoria, n.d.) and presents itself as "a contemporary music ensemble" (ibid.). In terms of performativity, the sonic laboratory at UVic's "Recent concerts have included Schoenberg's Pierrot Lunaire, Varese's Ionization and Octandre, Cage's Atlas Eclipticalis, Kurt Schwitters Ursonate, and various works by Stockhausen and Steve Reich" (ibid.).

According to Ajtony Csaba Szakacs, "The name comes from the time when the School of Music was too small for a full new music ensemble, and Sonic Lab seemed an appropriate compromise for contemporary instrumental and electroacoustic chamber music that occasionally is experimental" (Csaba Szakacs, 2024).

Following this description, the Sonic Lab UVic could be understood as an example of a sonic laboratory, an academic laboratory that studies sound art and contemporary classical and electronic music. This research shows that art practice may be identified well with laboratory practices that share experimentation and hands-on learning methods. The Sonic Lab UVic is a lab/ensemble that focuses on music research and development. It can also highlight the characteristics commonly associated with academic labs, such as emphasising research, education, collaboration, and the pursuit of knowledge within the field of music.

The Sonic Lab UVic organises gatherings for musicians who want to play and experiment with new tendencies in music composition. The lab is presented as an ensemble but transgresses the standard methods of traditional and classical music. Their approach to music is more experimental and facilitates collaboration among musicians. The primary interest of Sonic Lab UVic is to present and show practices by musicians who want to discover and explore contemporary composers further. Their sonic practice is artistic, defying conventional institutions through collaboration and openness. The Sonic Lab UVic promotes sharing and is open to all interested.

2.2.2 Laboratorios Sonoros (Musica UNAM, Mexico)

Laboratorios Sonoros is a Musica UNAM, Universidad Nacional Autónoma de México proposal. Musica UNAM's mission is to offer high-quality activities in different musical genres (Musica UNAM, n.d.). Among their objectives is to promote concerts and music that benefits the University community and society (ibid.). The Musica UNAM offers different programmed events for Mexicans and those from overseas, and it refers specifically to

concert music in the symphonic, chamber, and stage fields (ibid.). During Laboratorios Sonoros, Musica UNAM presented Mexican sound artists who were developing sound art, live coding, science and technology, and composition. These have included Arcangelo Constantini, Juan Jose Rivas, Marcela Armas, and Alexandra Cardenas, among many more. Laboratorios Sonoros has invited artists such as Maja S. K. Ratkje, Ellen Fullman, Daniel Lara Ballesteros, Guillermo Galindo, Yannis Kyriakides, Carlos Iturralde, Gibrana Cervantes, Constanza Piña "Corazón de Robota", Marcelo Toledo, Israel Martínez, Ana Paola Santillán, Jaime Lobato, Interspecifics and Wilfrido Terrazas, among others.

The Laboratorios Sonoros, which translates as sound laboratories, is an online platform that offers concerts by sound artists. This laboratory contributes to the sonic laboratory's definition as a space closer to the curatorial discipline of programming events. Laboratorios Sonoros provides an intimate look into the creative spaces of today's sound artists, exploring the behind-the-scenes of a contemporary sound artist's studio and also presenting the instruments and techniques that artists utilise, their artistic process, and the path from idea to the realisation of their projects.

According to Gabriela Peláez, Assistant Director of Music Programming, at Cultura UNAM:

> The laboratory fosters collaboration between diverse artistic disciplines, especially between music and technology, resulting in works that transcend the traditional boundaries of music. The work of the Laboratorios Sonoros encompasses both a scientific and artistic approach by the invited artists. From a scientific perspective, advanced technologies are investigated and applied, and auditory phenomena are explored. Artistically, works are developed that seek aesthetic expression and explore complex human and perceptual experiences" (Peláez, 2024).

Curating involves the aesthetic dimension of selecting, choosing, and creating artists' networks. This example presents a sonic laboratory definition as a curatorial platform offering sound artists and musicians adequate space to perform and practice. In doing so, this laboratory practice can define the sonic laboratory from a curatorial activity perspective.

2.2.3 Sonics Immersive Media Lab (SIML, Goldsmiths, University of London)

SIML is an "interdisciplinary, cross-departmental, world-class multi-media facility" (SONICS Research Special Interest Group, 2024). SIML's "research touches on the theory, practice, technique, and epistemologies of sound and image as a medium" (ibid.). The SIML facilitates "trans-disciplinary and multi-departmental" exchange, transforming the sonic laboratory into a medialab.

SIML contains "conceptual and technological advances" (ibid.). It encourages the critical perception of technology, including the creative aspects of the practical development of sonic and technological works. As a lab, the SIML facilitates technical support and an artistic perspective on developing sound works.

SIML uses the critical approach to technologies in its definition, and in doing so, it assimilates practices typical of the hacklab. A technology's critical approach can be seen in hacklabs that use open-source hardware/software. Most medialabs use open software/hardware, which are technical resources contributing to creativity. Due to its position within Goldsmiths, SIML is an academic laboratory dedicated to the technological study of sound from a critical perspective. Still, it typically assimilates practices from the medialab, as indicated by its interdisciplinary nature. In this sense, SIML is a medialab interested in sonic technologies mixed with other disciplines. This example identifies the conditions that may be possible for a sonic laboratory, with shared features with a medialab, highlighting a critical perspective and mimicking the interdisciplinarity of their studies.

2.2.4 The Sonic Laboratory (Sonic Arts Research Centre – SARC, Queen's University of Belfast)

SARC is defined as a "'cinema for the ear'" (Queen's University Belfast, 2024), which means it is "a specialist acoustic space designed to provide a unique and immersive listening experience - the auditory equivalent of an IMAX cinema" (ibid.). SARC has technical capabilities to support creatives in sound art research: "Forty-eight loudspeakers, strategically located, project and move sounds throughout the 360 degrees of the space, including above and underneath the audience" (ibid.). For this, the Sonic Lab is "designed with an acoustically transparent, modular grid floor suspended 4m above the basement level" (ibid.). These features made it a unique space dedicated "for teaching, public concerts, screenings, installations and for developing and implementing cutting edge research linked to the emerging creative industries" (ibid.). The laboratory tends to be in the group of sonic academic labs dedicated to developing the laboratory's technical capabilities.

Besides, the interdisciplinary approach typically found in medialabs highlights SARC as a sonic laboratory devoted to "virtual reality / augmented reality, immersive media, Dolby Atmos, loudspeaker design, music perception, musical interactions, new instrument design, and sound engineering" (ibid.). Furthermore, twenty years ago, composer Karlheinz Stockhausen inaugurated the SARC building after receiving an honorary doctorate from Queen's University Belfast. His ideas profoundly influenced the design of the Sonic Lab, conceived by Michael Alcorn. This aspect connects the laboratory with composition, a practice for producing sound works by artists in laboratory residences.

The technological aspect seems to be foundational in these types of interdisciplinary academic sonic labs. Consequently, the technological element could be included in a sonic laboratory's possible definition, although not as a unique or essential criterion, but as a component to be addressed critically.

This example answers my questions about the potential for sonic laboratories to become critical, alternative and hybrid. SARC incorporates composition techniques into technical development and thus avoids becoming a hyper-tech lab, i.e. a lab solely concerned with technological development. Moreover, its academic position within Queen's University and its frequent collaboration with resident artists and students may also include humanities subjects that transcend the purely scientific approach to sound. Incorporating non-technical and pure science elements, such as composition and listening, can attribute interdisciplinary value to sonic laboratories, contributing to creative explorations.

Conclusion

In this chapter, I explore sonic practices in laboratory environments through different laboratory examples. I list and show different laboratories that belong to either one of two categories of sonic laboratories:

- Artists in science labs through residences (or artscience labs). These laboratories involve collaborations between artists and scientific institutions, allowing artists to use scientific tools and concepts to develop sonic works.
- Academic sonic laboratories are research-oriented laboratories situated in educational institutions. They focus on music research and development and promote interdisciplinary collaboration.

Considering the examples of these two categories has provided me with more accurate information on how laboratories can become sonic laboratories. This involves focusing on sound practices and outcomes within the framework of aesthetic perspectives of sound, as well as technically and critically engaging with sonic activities, and through interdisciplinary mixing of sound with other disciplines.

This chapter aims to understand different types of sonic laboratories that already exist and, through their analysis, highlight the characteristics and methods that will help me explore their potential for challenging conventional laboratories.

Concerning the work of Šebjanič, Forcucci, Lang and Ikeda, I have observed that with the creation of sound works as an outcome of the artscience lab, the artists position themselves confidently in the laboratory, which consequently does not remain a place for science alone but also for creativity and experimentation through sonic practices.

Considering the artists above, I identify different practices used in these laboratories to produce sound works. For instance, I highlight many methods sonic artists use in laboratories (Šebjanič, Forcucci, Lang and Ikeda). Still, the ones that are of particular interest are:

- Ideation and prototyping – in Lang's work (further investigated in Chapter 3).
- Curating – in Šebjanič, Forcucci, Lang and Ikeda's work (further investigated in Chapter 4).
- Field recording – in Šebjanič's work (further investigated in Chapter 5).

The examples of academic laboratories as examined in this chapter, for example, SIML, reveal the sonic laboratory as a place for knowledge production and a place of science and humanities, offering the inclusivity required to model a hybrid and alternative laboratory. For example, SARC uses composition and listening, a sound art method investigated and mentioned further in Chapter 5 when defining field recording labs.

In conclusion, academic sonic labs contribute critically to the definition of the laboratory, as seen at SIML. Sonic laboratories in academic environments mix science and the arts and collaborate interdisciplinarily with artists. While discussing SIML, I also realised that a critical approach to technology is another aspect of sonic laboratories, which is crucial in my research. This recognition enhances a critical definition that may contribute to an alternative view of the laboratory.

Another essential aspect of the sonic laboratory to highlight is understanding the features of experimentalism, as seen in the Sonic Lab at UVic. Experimentalism (Sonic Lab at UVic) and critical approaches (SIML) can configure the potential of the sonic laboratory that this thesis searches for.

This thesis aims to find and pinpoint the curatorial possibilities of the sonic laboratory (seen in Laboratorios Sonors) as an alternative to institutional laboratories. Through this chapter, I have found evidence of collaborative working in science labs, which defines them as artscience labs, which in turn allows me to define the laboratory as an interdisciplinary place of experimentation, creation, and exhibition. This potential will be explored in Chapter 4 through a curating laboratory study.

These sonic laboratory examples show evidence of their existence and exemplify features and methods that will be explored in detail in the following chapters.

In Chapter 2, I present the case studies organised into two sections: the artists' residences in the science labs (artscience labs) and the academic sonic labs. Analysing sonic artists in laboratories provides me with the methods (e.g., field recording and prototyping) and

outcomes (e.g., sound-centric components and curating) employed in laboratories to examine what constitutes a sonic lab. This enables me to further develop my thesis by examining the findings of this chapter in the next chapters: laboratory methods (Chapter 3), curating (Chapter 4), and field recording (Chapter 5).

3. Laboratory Methods that Inspire the Sonic Laboratory

Introduction

Chapter 3 presents an analysis of various laboratory methods, building on the findings from Chapter 2. In this chapter, I work broadly, not only on sound methods, but within different laboratories methods, because I need to understand the possibilities of the sonic lab, as my research question asks. At this stage, I ask whether laboratory methods might influence and enrich a critical sonic laboratory. To answer this question, I review the methods identified in different laboratory types. For instance, I examine how learning by doing is employed in academic labs, following Dewey, and Beck and Bishop; how hackers use DIY in hackerspaces as understood by Garret and Catlow, and Bogers and Chiappini; and how archiving is employed in media archaeology labs, following media archaeology theory by Jussi Parikka and others. I also demonstrate how other methods, such as experimentation (with examples from Latour and Weibel) and prototyping (as defined by Arrigoni, and Bradbury and O'Hara), challenge conventional laboratory methods. At this stage, the hypothesis is that sonic laboratories would achieve better results through collaboration, exchange, dynamism, and tolerance, thereby facilitating knowledge creation and societal and cultural development. This articulates the potential in the laboratory method to defy imposed views of culture and science. By exploring these methods, I understand sonic, artistic, and curatorial practices that can develop the potential to introduce new ideas and practices and to challenge conventions. In this chapter, one finding is the use of archiving as a method in media archaeology labs. This is of great importance, as archiving is understood within media archaeology, which considers technological artefacts (including sonic apparatuses) across planetary, temporal, and material scales. This enables me to consider the planetary laboratory, which will be developed in Chapter 5. However, I first need to address another laboratory method that is important for experimentation and workshop methods: curation, which will be analysed in Chapter 4.

In the last chapter, I explored sonic practices in laboratory environments. I investigated sound artists in science labs and sonic practices in academic labs. Through these observations, I identified different methods artists and academics use when working with sound in the laboratory. For example, in the case of sonic artists working in laboratories, I can highlight that the methods used are many, but the ones that are of particular interest are:

- Ideation and prototyping – in Lang's work (further investigated in this Chapter 3).
- Curating – in Šebjanič, Forcucci, Lang and Ikeda's work (further investigated in Chapter 4).
- Field recording – in Šebjanič's work (further investigated in Chapter 5).

I highlight these three methods because they are present in the sonic artists working in laboratories: Šebjanič uses field recording and exhibitions, Forcucci applies the exhibition as a laboratory practice, as does Ikeda, and Lang uses prototyping as a method for making sonic apparatus.

Prototyping will be further explored here in Chapter 3, but I will also add other non-sonic methods to the discussion in this chapter. Therefore, in this third chapter, I will look at laboratory methods that contribute to an idea of the laboratory that is not institutional. The aim is to observe how alternative laboratories (hacklabs and media archaeology labs, for instance) may contribute to creating a hybrid sonic laboratory. The suggestion is that hacklabs can inspire some alternative, non-institutional behaviour for sonic laboratories through methods that are not necessarily sonic but that operate alternatively, offering possibilities to the laboratory, such as DIY, workshops, and archiving.

Therefore, in this chapter, I further explore laboratories' methods, such as learning by doing, DIY, prototyping, etc., applied in different laboratory typologies: academic labs, hacklabs, science labs, etc. Based on Chapter 2, which allows me to further clarify and develop sonic laboratories' potential in terms of becoming an alternative, hybrid and inclusive laboratory.

In this research about laboratories, one aspiration for alternative laboratories entails their capacity to generate new and critical ideas, solutions, and expressions that are not necessarily enabled by conventional and established institutional settings but instead arise from new contemporary laboratories, such as hacklabs and media archaeology labs. In this sense, I define alternative laboratories as those which provide the possibility to think imaginatively, meaning new suggestions and expressions that engage critically outside the conventional/colonial, industrial institutional regime as outlined through Bell Labs. I also study artists who work with new technologies in laboratories, such as hackers and coders. The hacklabs contradict hegemonic and mainstream laboratory conventions. As I aim to show, infusing hacker methods and others into sonic laboratories provides contexts of knowledge production, with a more inclusive, broader, and open way of creating products and ideas. In this sense, these methods may promote positive ideation through imagination, experimentation, and inspiration, providing results for plural and novel knowledge production. I will discuss these practices within the definition of hybrid and interdisciplinary experimentation. This offers me a potential to show sonic laboratories as challenging and experimental spaces, which may represent an alternative to the institutional-based capitalist/colonialist laboratory model.

To explore the hybrid and interdisciplinary potential of the sonic laboratory, I will study different methods in the laboratory, such as:

- Learning by doing.
- Experimentation.
- Prototyping.
- DIY (do-it-yourself).
- Hackathons and workshops.
- Archiving.

Some of these methods were presented in previous chapters; for example, in Chapter 1, through the laboratory survey, I show how experimentation is a constant practice in various laboratory typologies, such as science labs and artists' laboratories.

Other methods, such as prototyping, which is the capacity to create and ideate new objects, machines, or apparatus, appear as a method in Chapter 2 after analysing sonic practices in the laboratory.

Some methods studied in this chapter have appeared previously in Chapters 1 and 2. Here, I will focus on other relevant approaches that have not been discussed yet. This is the case, for example, of workshops and hackathons applied in hacklabs, hackerspaces, and alternative laboratories. These methods differ from those of technological corporations. Therefore, in this chapter, I demonstrate how they could contribute to understanding laboratory behaviour and envisioning sonic laboratories' potential.

Another laboratory practice analysed in this chapter is learning by doing. It is a specific method applied in academic laboratories, identified and defined in Chapters 1 and 2. As observed, academic labs can be controversial, presenting examples of possible institutionalisation through military-industrial connections (as with the American university model, seen in Chapter 1) or critical technological approaches (seen at SIML in Chapter 2). Exploring learning by doing as a laboratory practice may give me more details on academic labs' behaviour and, therefore, allow me to project a better sonic laboratory.

Another method that I focus on in this chapter is archiving. Specifically, I will demonstrate how archiving belongs to the methods applied in the media archaeology lab. The emerging field of new materialism significantly influences this laboratory. The media archaeology lab, for example, *Erkki Kurenniemi (In 2048)*, an exhibition lab that combines media archaeology, museology, computer arts, electronic music, curating, and art history, presented in Chapter 1, has been born from the need to re-think institutional medialabs and its problematics: lack of inclusivity and required balanced and situated collection practices, to name a few. Media archaeology, through methods such as archiving, challenges institutional

colonialism and proposes reframed laboratory practices that become an example for the sonic laboratory.

With this investigation and analysis, I want to understand how different methods can be applied in the laboratory setting to promote a more hybrid sonic laboratory that allows art and music to develop and move away from the view of the laboratory as a place of science. Through this chapter, I want to understand which laboratory methods can align and promote a hybrid lab model for the sonic laboratory.

3.1 Learning by Doing

"Learning by doing", a term coined by John Dewey, an American educator who championed progressive, practice-based education. Learning by doing is a hands-on approach to learning rather than passively receiving. It includes problem-solving skills, project work, simulation, and experiential education, but it is mostly the idea that we learn more when we do the activity.

Dewey connects the laboratory space with education and learning by doing, a practice and a concept that will be later applied in other laboratories and medialabs, such as MIT Media Lab and other examples of makerlabs and fablabs. Dewey also connects laboratory practice with learning by doing to other practices used in sonic laboratories, such as exhibiting, curating and testing through prototyping and experimenting, which will be studied later in this chapter.

Learning by doing also evolved to be the primary method in twentieth-century laboratories, for example, a method applied in specific academic laboratories. One example of such a laboratory, where learning by doing takes place, is "(…) the Laboratory School of the University of Chicago in 1869" (Beck and Bishop, 2020, p.19), which was founded by Dewey.

Besides the Laboratory School, Dewey compiled previous academic experiments and provided a new perspective on practising the arts in academia as a laboratory, in different locations across the US. This is important for this research since academic laboratories appear to be places where science, industry, and art merge to develop new practices that contribute to social change. In the authors' words, "The influence of Dewey's educational ideas extended beyond the US, [through] his notion of 'learning by doing'" (Beck and Bishop, 2020, p.22). Applying this method of learning by doing in the laboratory contributed to enriching new practices and social changes.

For Dewey, the laboratory "is the discovery of the conditions under which *labor* may become intellectually fruitful and not merely externally productive" (Dewey, in Beck and

Bishop, 2020, p.26). In his view, the laboratory is equivalent to artistic practices, and the confluence of both laboratory and art is essential to developing a creative vision of the laboratory. This seems important as a precedent of collaboration and hybridity.

Another example of an academic laboratory that adopted this philosophy is Black Mountain College, a private liberal arts college in North Carolina, established in 1933. It focused on holistic education and emphasised the importance of art in its curriculum. According to Dewey, "Under Rice and Albers, […] modelled itself, as a laboratory in this sense, providing the conditions under which experimentation might take place" (ibid.). Using different methods, academic laboratories that develop art practice transform the laboratory from a place of science towards a dynamic place of art, science and learning.

Dewey's theory owed much to the Bauhaus, and especially to "Laszlo Moholy-Nagy [who] joined the Bauhaus in Weimar at the invitation of Walter Gropius in 1923 and developed the foundation course for the school in that year" (Beck and Bishop, 2020, p.49). Bauhaus was centred on the education of the arts and design. Still, it incorporated the "new industrial materials, for building an emergent and semiutopian social urbanism [which resulted in] a key feature of this experimental educational practice" (ibid.). Bauhaus was for Moholy-Nagy, "the laboratory of [a] new movement […], a laboratory of form and movement" (Moholy-Nagy, in Beck and Bishop, 2020, p.49). These new art practices applied in the Bauhaus became the foundations for a "Deweyan (…) 'learning by doing' philosophy" (Beck and Bishop, 2020, p.49).

László Moholy-Nagy, a member of the Bauhaus, highlighted the importance of Dewey's theories for the Bauhaus philosophy and, in particular, to Moholy-Nagy, who took them up as an educational model for his teaching. In Moholy-Nagy's words, "The Bauhaus became the focal point of new creative forces accepting the challenge of technical progress with its recognition of social responsibility" (Beck and Bishop, 2020, pp.50-51). Learning by doing was an important factor in analysing the positive results from academic experiments, and it contributed to shaping the laboratory as a place of transformation and of influencing the social system.

Beck and Bishop highlight how the laboratory appears as a generator of societal transformation. In the authors' words, "conceiving of a design school as 'the experimental shop, the laboratory of the new movement' situates education at the centre of innovative social and cultural production, much as Dewey had conceived of the school as the engine of democracy" (ibid.).

Dewey was a pioneer in introducing the term laboratory into education. In November 1894, he founded the University of Chicago Laboratory School, initially named the Dewey School

and later renamed the Laboratory School. The school was seen as a laboratory of education. Dewey's school was a place of practice and a "scientific 'laboratory' staffed with college-trained teachers and devoted to research, experiment, and educational innovation" (Knoll, 2014, pp.455-458). Dewey used the word laboratory to explain how he wanted to establish a school that was an "'experiment station'" (ibid.), a place shared with students and teachers where to develop innovative ideas, building "a radically new system of education and teaching" (ibid.). In Dewey's words, "The conception underlying the school is that of a laboratory" (Dewey, in Knoll, 2014, p.5). It continues,

> "It bears the same relation to the work in pedagogy that a laboratory bears to biology, physics, or chemistry. Like any such laboratory, it has two main purposes: (1) to exhibit, test, verify, criticise theoretical statements and principles; (2) to add to the sum of facts and principles in its special line" (ibid.).

I understand Dewey's learning by doing with its emphasis on a laboratory's creativity, experimentation, hands-on learning, and other practical engagements, and thus its social responsibility as a radical engine for democracy, which is useful and necessary for effective academic labs. Following him, I believe, academic laboratories could adopt a more educational approach to develop an alternative to mainstream laboratories or those allied with the military-industrial complex, where progress for profit happens instead of education and creativity. Indeed, I contend that the utopian ideal of the academic laboratory based on art practices and experimental learning contributes to my imagining of a non-hegemonic/normative laboratory as it is sought in this research.

The next chapter section examines experimentation as a recurring feature in laboratory practice, exploring alternative practices that can inspire the sonic laboratory.

3.2 Experimentation

Experimentation is a method cited previously in Chapter 1 when studying science and artists' laboratories. Experimentation is also used as a method in artistic processes. Experimentation is part of the developmental process of an artwork and is vital for innovative outcomes. However, art is not science; for Frank Malina, "art is a fiction, science is a fact" (Lapointe, n.d.). The collaboration of art and science in the laboratory, as exemplified in Chapter 2 through the work of the artist Robertina Šebjanič and others, has created a model that results in interdisciplinary becoming artscience, a practice in which artists and scientists share processes and results. Lapointe suggests "artists whose work lies at the confluence of art and science/technology can advantageously influence research, for example by presenting new research topics, by inventing new technologies, by undertaking new experiments or by collecting new knowledge" (ibid.).

Experimentation is a constant phenomenon throughout artistic practices, and "it is more important to enhance the process of experimentation, not just the result of this experiment" (Edwards, in Lapointe, n.d.). Allan Kaprow defines experimentation in the arts as the "testing or trial of a principle" (Kaprow, in Lapointe, n.d.). However, the experimental process in art and science differs. According to Lapointe,

> The task of experimental artists is to deliver questions rather than answers. Experimentation then becomes a process of questioning, a testing of hypotheses, and questioning again, iteratively. The essence of this experimental approach holds much to the act of experimenting, and not just to the results and products of such experiments. (Lapointe, n.d.)

In science, the experimental process focuses on a systematic and empirical investigation of natural phenomena. Science uses experimentation to test and create hypotheses. Scientists use complex testing apparatus and machines, as well as data, to enrich their investigations. Then, through further research and publications, science researchers create the literature required to disseminate their findings. The ideation of prototypes is used in the scientific process to create objects (from facts) that will operate as black boxes. To explain the experimental method in science, I refer to Latour's explanation of laboratory processes:

> Laboratories grow because of the number of elements feeds back into them, and this growth is irreversible since no dissenter/author can enter into the fray later with fewer resources at his or her disposal (...). Beginning with a few cheap elements borrowed from common practice, laboratories end up after several cycles of contest with costly and enormously complex set-ups very remote from common practice. (Latour, 1987, p.93)

Experimentation, then, is an essential laboratory method in scientific processes, but it is also fundamental to the curating and exhibiting process. In Gabriella Arrigoni's words:

> both exhibition and experiment can be described as a process of discovery that comes from translating concepts into material form, to see how different aspects of this materiality may interact with each other in complex, not fully anticipated ways, and to thereby gain new insight into both these underlying concepts and the nature of immanent materiality itself (Lorimer, in Arrigoni, 2017, p.28)

The experimental process as a laboratory method is used in artwork creation and exhibition setup, for example, in Latour and Weibel's exhibitions, which I will discuss next. In this, I am guided by Arrigoni, who suggests, "part of the experimental process in art and laboratory practice is the idea about showing processes without a conclusive answer. This is part of the open-ended resolution in laboratory practice that Latour and Weibel present as a curatorial

model inspired by the open definition of the laboratory" (Arrigoni, 2017, p.28). This curatorial model entails appropriating experimentation as a process. Understanding the process allows curators and laboratory practices not to conclude closed and defined results, but instead to offer processes of open meaning. Latour is a philosopher and author with experience in curating exhibitions and applying laboratory experimental practices to curating. He has participated in curatorial processes in exhibitions at the ZKM and other institutions, exploring the idea of experimenting through exhibition practices. For example, Latour "has worked with Peter Weibel at the ZKM to produce the exhibitions Iconoclash and Making Things Public" (Basu and MacDonald, 2007, p.8).

According to Latour and Weibel, exhibitions applying experimental processes turn "into spaces for enactment, rather than representation" (Weibel and Latour, in Arrigoni, 2017, p.28). This means a change in curatorial, museological, and gallery practice where the display requires an active user to reformulate questions and answers. Because of this change, so Latour, "the display is turned into a space of knowledge production" (ibid.). Following this, an exhibition becomes a place for knowledge production through experimentation. In other words, "The exhibition is thus no longer conceived as a medium for representation, but becomes, instead, a medium for 'enactment'" (Basu and MacDonald, 2007, p.12).

A reconceptualisation of curating based on laboratory experimentation involves the public as an active agent. Thus, curating becomes a practice consisting of interpreting objects and creating exhibitions. However, curation demands the placement of objects within narratives, making the curator a storyteller. An experiment is vital in this curatorial turn towards knowledge creation instead of representation. In science, an experiment shows "empirical evidence as the basis for knowledge" (Basu and MacDonald, 2007, p.1). So, experiments were used "to establish (…) truths about the world" (ibid.), and thus, these became the basis for the scientific method. However, according to Latour, "experiments can be seen as a transformative process – for the people as well as the materials involved" (Latour, in Basu and Macdonald, 2007, p.2). Because of this, contemporary curating, when adopting laboratory practices, ceases to be a mere reproduction of the exhibited object and instead becomes a knowledge production practice. To produce knowledge, exhibitions share the notion of the experiment with the laboratory, and exhibitions are "experiments in meaning-making" (Basu and Macdonald, 2007, p.3). Curating will be explored as a laboratory practice in the next chapter of this thesis, Chapter 4 (Curating as a Laboratory Practice).

Latour fuses the two concepts of experiment and exhibition. Moreover, Latour's curatorial methods based on experimentation defy the hierarchy of a single curator (or a singular curatorial vision), inviting seven curators to the exhibition Iconoclash at ZKM. Instead, Weibel and Latour experiment with exhibition-making processes defined as ''interference

patterns’” (Basu and MacDonald, 2007, p.10), comparing the works of scientists in the laboratory with the work of the curator in the exhibition.

Furthermore, in *Making Things Public*, Latour and Weibel operate a different exhibiting dynamic, incorporating the spectator, the public, as actants that complete the process of constructing knowledge, as it "cannot be represented, it can only be 'enacted'" (Basu and MacDonald, 2007, p.12). Thus, through the experimental shift introduced in the exhibition, visitors become responsible for finishing the objects' meaning. Moreover, Latour and Weibel note, "it is an exhibition experiment that is what it shows" (Basu and MacDonald, 2007, p.13).

Experimentation is also a condition for sound art practices and sonic technologies. Most artists, such as Lang, as seen in Chapter 2, use experimentation in their approach to working through processes of art and science, for instance, when “he began by creating experimental mechanical sound objects” (Pe Lang, n.d.). Thus, experimentation can also be used as a sonic laboratory practice, challenging institutional processes of knowledge production.

Furthermore, experimentation is present in a laboratory context and is an artistic practice similar to prototyping, which will be examined in more detail in the next section of this chapter. In Chapter 2, I noted prototyping as a sonic method artists employ in artscience labs. A survey focused on prototyping will enable me to develop these ideas and to come to propose that laboratory methods enhance the sonic laboratory potential to critically challenge and confront hegemonic processes within institutional laboratories.

3.3 Prototyping

As discussed earlier in Chapter 2, prototyping is mainly used in medialabs and hacklabs, but can also be applied to other creative conditions. Prototyping is a “typical open-source” (M’Rithaa, in Bradbury and O’Hara, 2020, p.24) method which uses “equipment found in such Fablab workstations includes *inter alia*: 3D printers, laser cutters, milling machines, wood and metal lathes, band-saws, vinyl cutters, embroidery machines as well as basic metal-cutting and welding equipment” (Holm, in M’Rithaa, in Bradbury and O’Hara, 2020, p.24). Prototyping is based on hackers’ activities and practices, such as reverse engineering, recycling, circuit bending, tinkering, and rapid prototyping. It has an exploratory aspect that contrasts with industrial projects and scientific methods, as it becomes a dynamic process through collaborative practices (Maxigas, in Hache, 2014, pp.77-82). Prototyping uses new technologies such as DIY, 3D printing and laser cutting, which are present in most makerlabs and fablabs.

In this research, prototyping appears in Chapter 2, which includes the discussion of sonic artists in laboratory residences. The prototyping of loudspeakers in Pe Lang at the Swiss

Center for Electronics and Microtechnology (CSEM) entails ideation and prototyping as a transformation of sonic objects with “beneficial social impact [through] education, cultural exhibition, and production” (Edwards, 2010, p.23). In this chapter, I will demonstrate how prototyping can benefit sonic laboratories, hacklabs, and curating exhibitions, building on the case studies presented in the previous chapter.

Curatorial strategies are influenced by processes of artwork production through strategies used in hacklabs and makerspaces, such as prototyping. Prototyping “can inspire new approaches to interpretation and engagement, subverting established logics and introducing new values in curatorial work” (Arrigoni, 2017, p.108). This is because prototyping creates a new process of producing artwork. Prototyping is linked to hacking practices that bring new, creative, and imaginative solutions to art for developing new works.

Arrigoni introduces a specificity of prototyping, as a typical method developed in hackerspaces and hacklabs, but also with the capacity to “go beyond the traditional separation between episteme and techne that […] makes prototypes philosophical tools more promising than mere concepts” (Kera, in Arrigoni, 2017, p.140). This idea of a philosophical tool or techno-cultural apparatus developed in hacklabs through radical practices could contribute to criticising the imposing models of techno-capitalist society through gadget development and consumption. Apparatuses developed in hacklabs through prototyping could be seen as revolutionary mediated technologies that propose transparency, openness, and situated practices. These apparatuses can influence the sound and sonic technologies, apparatuses, and instruments developed in sonic laboratories, and thus, prototyping is a method to consider when understanding sonic laboratories.

An example of prototyping as a laboratory method can be found in the Agbogbloshie Makerspace Platform, a "maker lab/space, with its aims of collective work, community, and prototyping: to join hands to prototype tools and co-create a hybrid digital-physical platform for recycling, making, sharing and trading" (Parikka, 2016). This is an example of a laboratory outside the Western-centred laboratories' visibility in a different geopolitical context. Laboratories out of the Western area represent a geopolitical alternative supporting a decolonial laboratory approach based on feminist notions of situated knowledge.

Another example of prototyping is found in The Maker Movement in Africa, which “has its origins with the introduction of Fablabs – fabrication laboratories, by Neil Gershenfeld catalysing and democratising personal fabrication, with the vision of the continent’s vast potential for innovation” (M’Rithaa, in Bradbury and O’Hara, 2020, p.24). Fablabs typically use “open-source rapid prototyping equipment, 3D printers, laser cutters, milling machines,

wood and metal lathes, band-saws, vinyl cutters, and embroidery machines, metal-cutting and welding equipment" (ibid.).

As decentred from the laboratories' Western perspective, Agbogbloshie Makerspace Platform and The Maker Movement in Africa exemplify a new geological turn in the laboratory definition. Because prototyping entails the introduction and invention of new means of doing things from plural and contingent situations, thus it promotes global inclusivity through decolonial processes that give relevance to local areas. It encourages a shift from historically colonised ways of understanding science, offering more situated, inclusive, and respectful approaches. Prototyping is a method applied in laboratories situated in the extra-radius of the European and American Western culture (still rooted in colonialism and capitalisation of practices, developing and producing tools). Indeed, prototyping would be defined as a method to develop tools that are not business-centred, characteristics that could contribute to a non-hegemonic laboratory perspective.

There is also an example that uses prototyping as a central laboratory method in Shenzhen, in Hong Kong, a city situated on China's border. This city is named the "'Mecca for makers' with cheap electronics parts and an unbelievably fast prototyping capacity" (Tsao, in Bradbury and O'Hara, 2020, p.178). Using hacking methods in Shenzhen has contributed to developing what is known as "'Shanzhai' products" (ibid.). Shenzhen's prototyping activity to enhance ways of productivity is seen as "'the sincerest form of rebellion,' a type of 'hacking' when considered in a border context" (ibid.), and also a way of using open-source systems to innovate and develop cultural exchange, as is demonstrated through the collaboration with the Victoria and Albert Museum and the Shenzhen local government. Again, another link of prototyping as a method developed in laboratories that contributes to implementing curation, influenced by making communities and the manufacturing scene.

As seen in Shenzhen, prototyping represents the free and open-source productivity model, which can counter conventions and hegemonies. It belongs to the counter-culture community, developing workshops and promoting sustainability, and is rooted in municipal policies, openness, and experimental spaces (Kohtala and Ede, in Bogers and Chiappini, 2019, pp.278-284).

Moreover, prototyping appears influential in curatorial tendencies, but it also influences how artists create art objects, as it is a new production technique. In Nora O. Murchú's words, "The shift in the art object (…) points to an emerging model of practice where a culture of prototyping and making is becoming central to how artists are producing their work" (O. Murchú, in Bradbury and O'Hara, 2020, p.166). Indeed, prototyping impacts cultural environments such as academia, museums, and artistic research. Through the appropriation

of technology and influenced by maker culture, proposing prototyping as one of their principal methods, artists innovate by developing practices and objects that are subversive and aesthetic. According to O. Murchú, the appropriation of prototyping by artists results in more independence when creating, and "it allows for this prototyping process to be seen as a strategy for engagement that opens up possibilities for both artistic and curatorial actions" (ibid.).

Irene Papadimitriou, curator of the Digital Design Weekend at the Victoria and Albert Museum in London, explains how prototyping influences curation. In Papadimitriou's opinion, "When it comes to our digital programmes, (…), prototyping and collaborative making sessions [are] an important objective for these events (…) to think through ways in which we relate to the world" (Papadimitriou, in Bradbury and O'Hara, 2020, p.207). Through curating events and festivals influenced by prototyping in maker culture, the curatorial proposal is "to stimulate critical thinking and to place technology in the context of society and current challenges" (ibid.).

Through these references and contexts, laboratory practices such as prototyping can contribute to viewing the laboratory as a place for productive collaboration, openness, and inclusion, creating more human solutions for environments, communities, and cities. Methods such as experimentation and prototyping can propose a hybrid and critical view of the laboratory, decentred from the Western cultural perspective and adopting other essential thinking practices.

In this section, I considered prototyping's particular position as a laboratory method. Citing examples of the Agbogbloshie Makerspace Platform, *The Maker Movement* in Africa, and Shenzhen in Hong Kong, I have shown how prototyping proposes decolonial, critical and ethical practices that allow situated knowledge production in a non-Western context.

This suggestion connects with my research's aim of exploring the potential for sonic laboratories as locations for decolonial and critical as well as ethical practices and plural knowledge production. I believe that sonic laboratories can benefit from using and applying prototyping, which entails proposing situated practices in non-Western contexts that can influence decolonial practices. Prototyping exemplifies a resistance and critical approach to technological corporations and institutionalised laboratories. Then, sonic laboratories may develop their critical potential through practices such as prototyping when developing sonic objects and apparatuses.

Prototyping uses experimental methods and techniques that connect with DIY, as both are applied in hacklabs, hackerspaces, and makerlabs. Therefore, the next section of this chapter is dedicated to studying DIY as a practice in alternative laboratories.

3.4 DIY (Do-It-Yourself)

DIY stands for do-it-yourself. It is a method used in ethical hacking, a practice of making and re-purposing objects, magazines, clothes, technologies and many other things, by applying self-techniques of bricolage and hacking. Hackers are coders and computer science professionals who rarely "[have] completed a formal education degree through universities or professional training" (Spideralex, 2018, p.16). Instead, most of them have

> developed their technical skills and knowledge through informal and non-formal learning spaces, combining Do It Yourself self-taught dynamics with Do It Together/Do It With Others projects which ease the transfer of know-how between their participants (feminist hackerspaces, hacktivist feminist initiatives, hacktivism in mixed environments, etc) (ibid.)

Hackers' DIY design of Information and Communications Technology (ICT) is "trying to advance technologies with concrete applications that can improve the lives of others without creating more dependency and colonisation situations" (ibid.). This self-taught component in hackers' activity keeps them away from academia and institutionalised contexts, meaning that they do not ordinarily participate in standardisation processes and, on the contrary, contribute to creating alternative practices and spaces.

The expression do-it-yourself is found in the book *Do It! Scenarios for a Revolution* (1970), by Jerry Rubin and Abbie Hoffman, who founded the Youth International Party (1967-1968). They were American hippies promoting political activism and radical activities such as riots against the Vietnam War. Their core ethics were against racism, and they subscribed to Marxist ideologists and followed leaders of the Cuban Revolution, such as Che Guevara. In the book, Rubin and Hoffman state, "It's a do-it-yourself revolution, and we'll work out the future as we go" (Rubin and Hoffman, 1970, p.126). During the mid-1970s, the concept was appropriated and extended by punk movements in both New York and the UK. They promoted criticism of alienation capitalism through practising do-it-yourself: “The revolution has replaced the schools as the country's educational institution” (Rubin and Hoffman, 1970, p.244) or “We discover the love and brotherhood of a community that is fighting together for its own survival. […] Amerika is falling apart: the alternative is revolution or catastrophe” (Rubin and Hoffman, 1970, p.243). Their slogans promoted anti-consumerism and independence against political elitism. They were self-taught in the arts and music and produced their own musical labels, publications, fanzines, and magazines, and their roots were similar to Situationism, in using provocation, virulence, and black and caustic humour.

In the mid-90s, collaborations with artists, techies, and activists across the web were established to build "interdependent, semi-autonomous, semi-permanent places, spaces, resources and contexts, to grow more various alliances, perspectives and interests" (Catlow and Garret, in Bradbury and O'Hara, 2020, p.42). In this direction, Furtherfield, through collaborative practices influenced by these movements, sets itself up as an arts organisation that "coined the term DIWO [Do It With Others] in 2006 as an update of the original DIY spirit of punk and early Net Art" (ibid.). The organisation functioned as a laboratory, and the use of DIY and DIWo also extended to other laboratories. Using these methods entails collectivity and communality, which is a behavioural practice defended by feminist labs too.

More definitions of DIY can be found in Cindy Kohtala and Sharon Ede, who understand DIY as part of "materialist grassroots groups (DIY maker-activists) [that] create not only their local products and technologies but also spaces, communities, practices, narratives, and economic models" (Kohtala and Ede, in Bogers and Chiappini, 2019, p.279). A good example of this is “initiatives such as gardening and agriculture, Right To The City2 actions, and repair, reuse, and recycling events” (ibid.). These types of DIY practices promote participatory events "against consumerism [characterised by the] anonymity of mass production, and the neoliberal policies […] of innovation [and] economic growth" (ibid.). Moreover, DIY appears to be a "techno-utopian" (ibid.) movement promoted by maker activists based in makerspaces, a laboratory type where artists, hackers, and activists work with "digital fabrication equipment and computer-controlled tools" (ibid.), promoting the slogan "repair, reuse, recycling" (ibid.). DIY is a method for activists who develop workshops in fablabs, makerspaces, and hacklabs.

DIY "resist[s] commodification, defending community values and retaining an alternative, countercultural identity" (ibid.) that dismisses "'mainstreaming'" (ibid.). The DIY practices result in "maker experiments" (ibid.), which could be considered "post-capitalist […], marginal, [and] precarious" (ibid.).

DIY is used in specific laboratories, from academic labs such as the Black Mountain College to makerspaces, fablabs, and hackerspaces, for instance, Hackspace, “a non-profit hackerspace in London: a community-run workshop where people come to share tools and knowledge” (London Hackspace Ltd, 2025). These promote post-growth, a critical reflection around theories of economic growth influenced by degrowth and technological sovereignty, which are "alternative economic models" (Kohtala and Ede, in Bogers and Chiappini, 2019, p.280). They aim to "localise aspects of production and create value" (ibid.). DIY hackerspaces and hacklabs promote themselves as "community spaces" (ibid.), where activists develop alternatives for communities. These types of laboratories, through the

application of DIY, are "self-organised, [promote] open access, [and] free culture spaces [through] a charitable foundation, […] volunteer efforts and grants" (ibid.).

DIY activists develop their laboratories that are "environmentally oriented" (ibid.) and focus on "hands-on practice about renewable energy, gardening, and food self-sufficiency" (Kohtala and Ede, in Bogers and Chiappini, 2019, p.281).

Artists also collaborate with DIY ethical hacking and are part of this community. DIY hacktivists take care of "wastelands and derelict areas of transforming post-industrial cities" (ibid.) through "community workshops" (ibid.), where they develop "experimental prototypes" (ibid.). One example is “Turntable (…), a community farm located at the Pasila railway yard, a laboratory for sustainable food production and urban planning, and a center for peer learning and urban culture” (Turntable, n.d.).

DIY spaces such as hacklabs and others promote "open access, community-based workshops" (ibid.) and "alternative, local economies" (ibid.). Their practices are critical but precarious, and their spaces are laboratories that function as "incubators, […] cooperatives, [or] makerspaces" (ibid.). These laboratories are "shared community spaces" (Kohtala and Ede, in Bogers and Chiappini, 2019, p.282), interested in the DIY maker culture that radically differs "from the capitalist growth paradigm" (ibid.). On the contrary, DIY maker-activism proposes an "urban environmental sustainability" (Kohtala and Ede, in Bogers and Chiappini, 2019, p.283) based on the "green economy discourse" (ibid.). Some examples are Arduino and Raspberry Pi, open-source hardware and software organisations that promote technology through ethical use. Another example is that Open Source Ecology “is accelerating the growth of the next economy - the Open Source Economy - an economy that optimises production and distribution, while promoting environmental regeneration and social justice (Open Source Ecology, n.d.). In addition, another example of a laboratory interested in DIY is “Noisebridge […] a physical space open and welcoming to all, providing infrastructure and collaboration opportunities for anyone interested in programming, hardware, crafts, science, robotics, art, and technology” (Noisebridge, 2024).

Maker activists adopt the DIY method in laboratories and autonomous zones and are "constantly probing and prototyping" (ibid.). They also promote other terms such as "DIT for Do-It-Together and DIWO for Do-It-With-Others" (ibid.). DIY practices are developed through a "'free and open-source' model [that] is not business-as-usual" (Kohtala and Ede, in Bogers and Chiappini, 2019, p.284). What this means for the laboratory is an approach to counter-cultural processes against business-centred, for-profit institutions. It can be said that creativeity and experimentation are enhanced as a force of creation, rather than being driven by money.

The definition of DIY as a method for hackers, activists, and artists used in different laboratories, such as hacklabs, makerlabs, and fablabs, proposes the laboratory as a place against techno-capitalist development models. DIY opposes laboratory processes of profit and privatisation of access to knowledge. DIY does not only involve testing and refining a product idea. It can entail ethical considerations by emphasising creativity, bricolage, and object ideation. The DIY method is, in essence, an open-source method used in hackathons and other examples of alternative laboratories.

Laboratories developing through applying DIY propose "an alternative to industrial manufacturing, [that includes] participation, [promotes] democratisation of manufacturing processes, as well as a return of off-shored production back to local communities and the unboxing of global supply-chains" (Critical Media Lab, in Bogers and Chiappini, 2019, p.49). This is thanks to “additive design processes [such as] 3D printing” (Critical Media Lab, in Bogers and Chiappini, 2019, p.50) applied for example in Critical Media Lab's Merle Ibach (Junior PhD Researcher).

Understanding DIY as a laboratory practice allows me to rethink the laboratory as an artist's space and how to use DIY to promote a more ethical and critical production discipline. Moreover, DIY as an arts and laboratory method is introduced in Chapter 1 through the example of Hugh Davies' Electronic Music Studio (EMS) at Goldsmiths, University of London, 1968. Constituted in academia, Davies worked on self-built instruments. Thus, he could be considered a pioneer through his DIY practice in modifying "electronic sound apparatus in his early live electronic compositions (…), through the 'instrumental turn', represented by his first self-built instrument" (Mooney, 2017, p.1). Davies contributed through his sound art practice to defining the laboratory concept in artistic and academic environments. With his DIY approach, Davies contributed to teaching and learning in a more hands-on experience, applying learning by doing. DIY sonic laboratory practices exist in examples such as Astrovandalistas, MusicMakers Hacklab and MusicHackspace, cited in Chapter 1: Medialab, Hacklab and Other Typologies.

These DIY practices focusing on sonic apparatuses or making/building instruments have inspired my practice as a curator through the exhibition *Sounding DIY,* 2017, which:

> highlights DIY practices versus capitalist mass production. The exhibition represents a substantial change in the creation of prototypes of musical instruments and sound objects in our contemporaneity. *Sounding DIY* works with almost thirty artists in the field of DIY culture, promoting the efficiency of results obtained, both aesthetically and ideologically, through the design of musical instruments and sonic objects. This exhibition tries to foster a community of artists, tool developers and creative

> professionals interested in supporting and understanding artistic practices developed with technologies (Netz, 2014).

The exhibition continued with a series of events in Split, Croatia (2018) and Folkestone, UK (2019), showing

> artists in the field of handmade culture, music, sound art, art and technology and digital media. It focused on the practice of hackers and makers at the intersection of art, science, technology, sound art, and music production. The development of musical prototypes within the artistic sphere is presented as a contemporary paradigm that transforms the inertia of the capitalist system with hacked prototypes. In this change of production logic, the art/music relationship presents the sphere of techno-capitalism as an unsustainable and abusive threat. In the exhibition, we collaborated with artists who develop musical instruments to offer solutions to the current production system" (ibid.)

I understand The *Sounding DIY* exhibition as an example of an exhibition lab, a category named and described in Chapter 1. Exhibition labs have the critical potential to enhance laboratory practices through tendencies such as media archaeology that interrogate institutional laboratories/museums' current practices and archiving methods still rooted in a colonial past of acquisition and display. This example entails the sonic and the laboratory concepts this thesis interrogates under the sonic laboratory potential. If *Sounding DIY* can be understood as an exhibition/sonic laboratory, it will be an example of what I know of sonic laboratory criticality and laboratory models to tackle institutional practices. It will be further explored in Chapter 4 about curating and laboratory practices.

DIY is mainly used in hacklabs and hackerspaces, and it connects with other methods developed in these types of laboratories, like hackathons and workshops, which are analysed in the next section.

3.5 Hackathons and Workshops

Following on from and related to DIY practices, here, I analyse hacklabs' methods, such as workshops and hackathons, to explore the laboratories' practices that are useful to think the sonic laboratory. Hackathons and workshops are methods derived from hacklabs. In Chapter 1, I analysed whether these laboratory typologies are an alternative to the hegemonic laboratory culture in science and big tech. Since hacklabs operate through methods, such as workshops and hackathons, in this section, I study whether they could help influence the sonic laboratory better and influence art institutions such as museums and galleries.

The workshop is a genuine method of medialabs and hacklabs, which develop through hands-on, learning by doing, community and using DIY practice. Good examples of workshops are designed, for example, in media and sonic arts festivals. One example is the workshop *Sonus Verbosa, Anastasia Melandinou (GR)* at PIKSEL24. Piksel is a festival of sound and media that interrogates technologies less conventionally and distantly from the mass production means in big tech, supporting and giving opportunities to artists, musicians, and hackers. In the workshop *Sonus Verbosa, Anastasia Melandinou (GR)* "dives into audio-reactive typography design (…), merging sound and visuals" (Piksel, n.d.).

Fig 1. Sonus Verbosa, Anastasia Melandinou (GR). Copyright Piksel.

Like the workshop, some hackathons apply open-source technologies and the concept of "hack" to elaborate or remake new works in intense meetings and collaborations. Hackathons consist of a collaborative practice "that occur over a short time frame (from a single day to 48 hours), which encourage problem-solving and co-making" (Bradbury and O'Hara, 2020, p.133). One great example of a hackathon is the *International Synth Design Hackathon* hosted by SARC. SARC is presented in Chapter 2 of this research as an example of a sonic/academic laboratory that presents technical solutions to audio and sonic arts. The hackathon "invited participants from inside and outside QUB, beginners and the more experienced alike to build their own sound experiences using microcontrollers and various digital fabrication technologies such as laser cutters and 3D printers" (Queen's University Belfast, 2024).

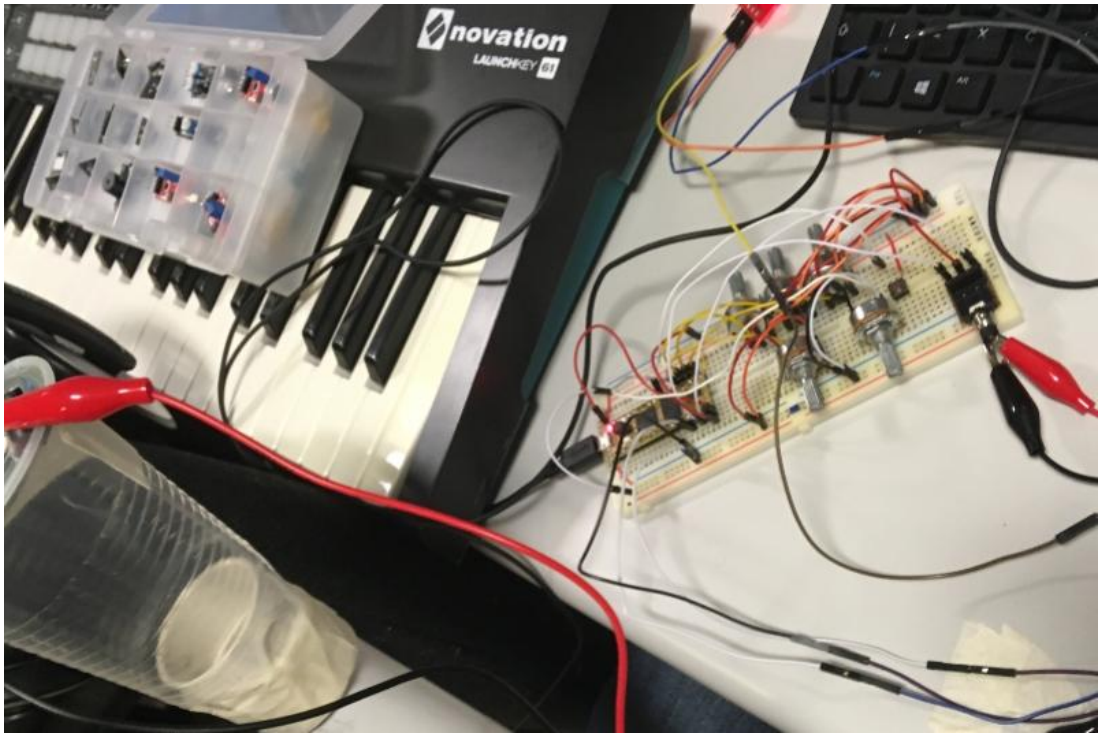

Fig 2. Hackathon. Copyright SARC.

Hacklabs developing workshops and hackathons mainly use open-source, a technology that appeared during the 90s as an alternative to corporate computing. Through open-source, hackers established their medialabs, which in time became hacklabs, hackerspaces, makerspaces, fablabs, biolabs, and more recently, feminist hacklabs. Gabriella Arrigoni states, “Great emphasis is also given to their Open Source ethos and their preference for collaboration and transdisciplinarity. Media-labs are frequently conceived as socio-technical projects addressing social needs and striving to engage ever larger communities, especially marginalised groups, with an open-door approach that involves all participants in maintaining the space and its resources” (Arrigoni, 2017, p.20). Examples “The Zero Dollar Laptop project, for instance, consisted of workshops to teach homeless people how to build a laptop using recycled hardware and open-source software (Furtherfield, 2010). Shrimping It introduces prototyping to various communities as a tool for education and empowerment (Shrimping it 2013)” (ibid.).

Hacklabs and others differ from institutional laboratories, museums and galleries, firstly for the use of open-source, secondly because their outcome is workshop-based, meaning there is no outcome but only a collective process, and thirdly, their mode of operation is through this process. In Arrigoni’s words, “[hacklabs] differ from museums and galleries primarily because they generally reject the format of the exhibition in favour of activity-based events like workshops” (Arrigoni, 2017, p.21). Sonic art is a practice that also entails processes and

is represented through many examples of workshops, as seen previously in other hacklabs. If sonic laboratories follow the example of hacklabs, they will use workshops as a method. This research includes Piksel and SARC, Astrovandalistas, MusicMakers Hacklab, and MusicHackspace, which all develop workshops around examples of sonic art, sound art, and music.

Hackathons are a type of workshop that brings together artists, coders, hackers, and curators to ideate, fabricate, or construct prototypes and artworks after many hours together in a shared environment of developing and creating. The hackathon and the workshop challenge and subvert the traditional exhibition and curatorial model. One example is the hackathon that took place at the Tate Modern in 2014. According to Arrigoni, "the Tate Modern, arguably the most prominent venue for mainstream contemporary art in the UK, hosted its first 24-hour hackathon. 140 creative practitioners and technologists were invited to develop artworks" (Arrigoni, 2017, p.1).

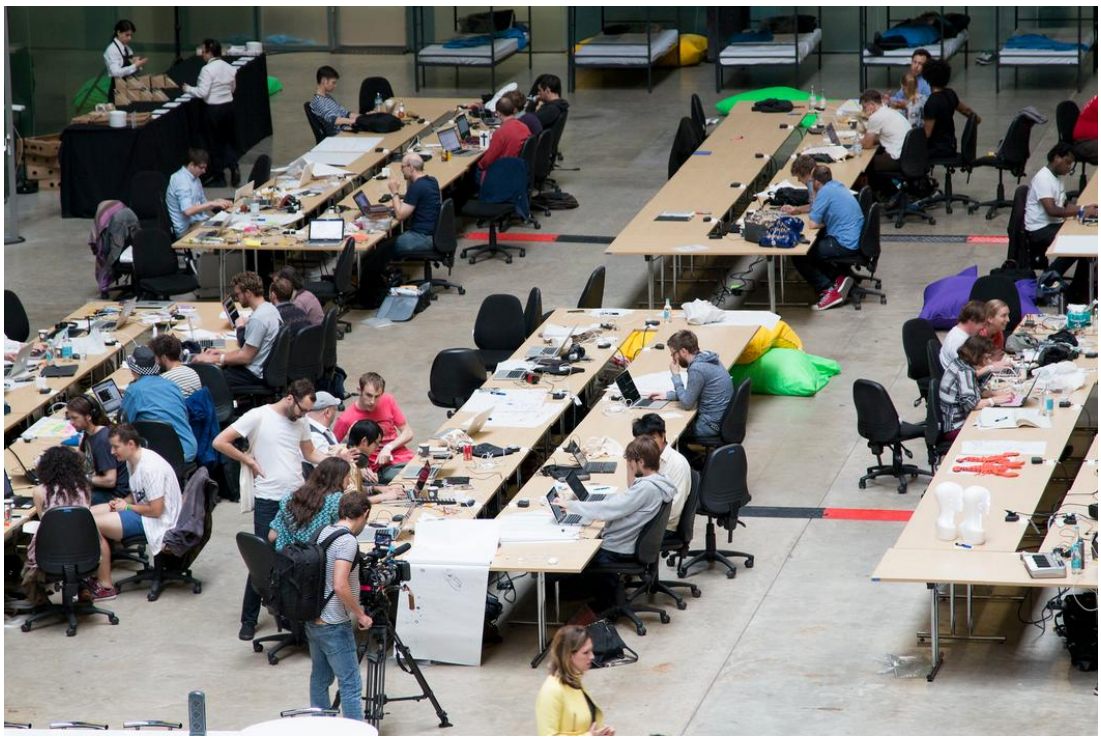

Fig 3. The Space: Hackathon - the Tate Modern. Copyright Open Data Institute.

This example shows that institutions participating in the hacker subculture are repurposing the exhibition models by adopting hacklab methods such as workshops and hackathons. Referring to Arrigoni, "Hackathons are re-fashioning the idea of the 'hack' as a public event bringing together some of today's most noticeable tendencies in cultural life: collaboration, the emphasis on process, and the alliance between art and technology to produce innovation" (ibid.).

From this definition, hackathons are Trojan horses in cultural institutions that could transform institutionalised and mainstream galleries. Arrigoni says hackathons are interested in "turning the making process into something visible" (ibid.). Hackathons are characterised by "Making, participation, and innovation" (Arrigoni, 2017, p.2). This defies traditional curatorial museology because "'making things together', collaboratively (such as in a hackathon), [opens up] the production process" (ibid.). Hackathons are developed by hacklabs and influenced by makers and prototyping culture, with values such as "Participation, remaking, process and speculation" (ibid.).

In this research, I also explore the influences of hackathons, hackers, makers, and open-source and DIY methods. These processes challenge traditional curating methods, as Arrigoni states:

> The curatorial […] introduced in the past decade […] a variety of formats that turned processes and making into public events, as opposed to traditional exhibitions displaying finished static artifacts. Workshops, hackathons, maker-fairs, demo sessions, presentations of work in progress, and field-trips, either directly involve the public in the making, or turn the making into a (semi)public event in its own right (Arrigoni, 2017, p.3)

This links with the curatorial, as mentioned in the experimentation section of this chapter, and also links to the following chapters. For example, Chapter 4, where I will explore curatorial practice as an experimental process capable of contributing to defying rigid impositions in institutions.

While examining workshops, I discovered different models and types of laboratories that propose working with open culture. Open culture characterises laboratories based on collaboration, and inclusive and critical practices, such as hacklabs and makerspaces. In Mugendi K. M'Rithaa's words, "Expos, fairs and public engagement, accessible expos, festivals, and competitions could complement existing strategies for the diffusion and dissemination of creative outputs by generating greater public awareness of the benefits of a Maker culture" (M'Rithaa, in Bradbury and O'Hara, 2020, p.28).

Through artists approaching hacklabs, the hackathons are influencing the laboratories' potential to dissent and challenge more institutional laboratories. Moreover, processual practices applied in hacklabs determine new ways of exhibiting related to curatorial practices, and artists use hackathons to develop a new working style. Following Bradbury and O'Hara, "The 'hackathon format', however, is considered to have been appropriated by the arts and cultural sectors […] as a way for artists and organizations to work in an experimental, low-risk way" (Bradbury and O'Hara, 2020, p.134).

Hackathons and festivals, as Trojan horses inside the institution, such as the Digital Design Weekend at the Victoria and Albert Museum, appear in the art scene as a mixture of "artists, hackers, makers, creative coders, engineers, scientists, data architects, technologists, arts and cultural professionals, venues" (ibid.). The artists' participation in hackathons has grown the laboratories' potential because it represents a transformative entry of subversive elements into traditional institutions. This participation can significantly expand the possibilities within laboratories and institutions, offering critical solutions through which artists may challenge established norms, hierarchies, and structures.

For Bradbury and O'Hara, hackathons are "anti-disciplinary practices emerging at the intersection of arts, culture, creative digital industries, design and engineering" (ibid.). In terms of exhibiting, hackathons offer new possibilities for artwork presentation, directly influenced by how hackathons produce work. The mode of production directly affects the curatorial mode, and this is because other methods, such as prototyping and experimentation, participate in collaborative creation in hackathons held in museums.

Moreover, most curatorial proposals from hackathons are public events or "'an informal showcase'" (Bradbury and O'Hara, 2020, p.137), not an exhibition of the work produced during the hackathon. It lacks curatorial input, meaning there is no selection and collocation of pieces attributed to a specific narrative chosen by a curator. Instead, the showcase presents the works as they have been produced. This informal showcase is interested in showing the prototypes resulting from the intense collaborative hours of hacking together. Thus, curating hackathons generally does not produce curated exhibitions in the traditional sense but showcases objects, practices, and results. An example of this practice is the Transmediale 'Afterglow' Art Hack Day:

> Art Hack Day [is] a grassroots event/exhibit format/community for artists whose medium is tech and hackers whose medium is art. This event gathers more than 80 participants working intensively for two days at the start of the festival to come up with an instant exhibition that responds to the thematic framework of afterglow. Collaborative in nature, Art Hack Day is a project dedicated to cracking open the process of art-making, with special reverence toward open-source technologies. As an event it bridges the gap between art, technology and entrepreneurship and expresses a belief 'in non-utilitarian beauty through technology and its ability to affect social change for public good'" (Transmediale, n.d.).

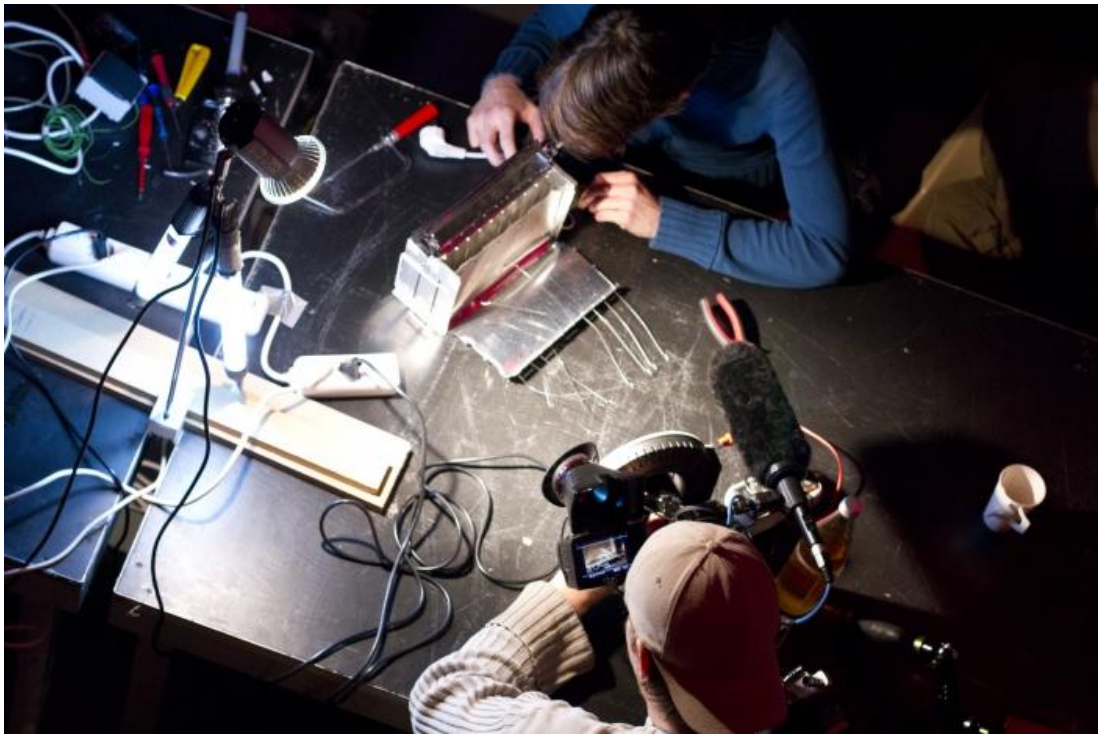

Fig 4. Impression of "*Art Hack Day Berlin : Afterglow*". Copyright Halea Isabelle Kala / Transmediale CC BY SA 4.0.

Another exciting aspect of workshops is the potential to challenge traditional curating. In Nora O. Murchú's words, to interfere in the curatorial process means including elements such as participation that "opens the possibility for a culture of critical, informed and reflective practice that incorporates new strategies and critical approaches from making" (Murchú, in Bradbury and O'Hara, 2020, p.167). This idea of participation as essential to current traditional curating may inspire the development of the sonic laboratory.

Indeed, following Tania Aedo, maker, hack, and DIY ethos through processes such as workshops and hackathons "are among the processes under constant inquiry in curatorial and museum practices, especially when they cross boundaries of disciplines or realms" (Aedo, in Bradbury and O'Hara, 2020, p.197). From this position, Aedo explains how methods from hacklabs and others, such as "hands-on meditative collaborative processes" (Aedo, in Bradbury and O'Hara, 2020, p.198), contribute to forming a hybrid space, a term also used by Darren Wershler, Lori Emerson, and Jussi Parikka to define the required reformulation of the unique scientific laboratory that includes a notion of the laboratory acknowledging variety and complexity. Hybrid labs could also represent what I refer to in this thesis as alternative laboratories in that they address and tackle critical imbalance and inequality, as in feminist labs (explored in this research in Chapter 1). One of the results of

applying hacklabs methods, such as workshops in laboratories, can be seen in the relationship between audiences and exhibitions. As Aedo states:

> Maker DIY and hack-style approaches consider what people are taking home after the exhibition or event – whether in terms of experiences or knowledge sharing. Audiences are sensitive to this, and they come back looking for more of these kinds of interactions. As we have discovered this as an institution, we have learned to include museum-hackers on our team and take on some of these strategies ourselves as we assume this museum-hacker position. (Aedo, in Bradbury and O'Hara, 2020, p.203).

With this idea of the workshop as a laboratory method, I want to end this section and introduce another method that helps me analyse laboratories that could inspire sonic laboratory possibilities. I believe that the strong relationships between laboratories and workshops could address the issues of hegemony in laboratories, as outlined in earlier chapters. Thus, they could define possible alternative/hybrid laboratories, such as the media archaeology lab (as seen in Chapter 1, media archaeology lab *Erkki Kurenniemi (In 2048)*), which, as I will show in the next section.

In this next section, I investigate the media archaeology lab, which shares aspects with hacklabs, such as using DIY and prototyping methods, but focuses on archiving as a method. Although archiving could be an institutional practice in museums, I will investigate whether the media archaeology lab turns archives into alternative/hybrid spaces that can inspire sonic laboratories. I will use this survey to answer my research question about the sonic laboratory based on hybridity as a critical potential.

3.6 Archiving

Following workshops and hackathons, I want to introduce archiving as a method used in institutional environments—archives and museums—but brought to laboratories, such as media archaeology labs. I want to investigate how this shift from the archive as an institution to the laboratory transforms archival methodologies to influence the definition of the laboratory as a hybrid space and to inspire the sonic laboratory.

In this section, I want to introduce Jussi Parikka's media archaeology theory, which is dedicated to investigating media archaeology labs, considered places to analyse old technological artefacts, from cinema apparatus to sound instruments and computational machines. In addition, some practices in the media archaeology lab can contribute to understanding the critical potential of sonic laboratories, as media archaeology labs promote work with sonic devices. Media archaeology labs are defined as follows:

> However, in many cases, one calls such places of interaction with old objects, cultural heritage, […] media laboratories. For sure, it is a term usually reserved for scientific practices and preserves the connotations of big science labs but increasingly over the past years has been used also in contexts of the humanities (Earhart 2015). This particular, more modest and grassroots-scale sort of lab activity of shared spaces [uses] hands-on approaches, methodologies of tinkering, and collective 'doing it together' spirit. (Jucan, Parikka, Schneider, 2018, p.21).

Media archaeology labs deal with physical archival material and propose an "extension of practices of remains from the archive to the lab or the maker space." (Jucan, Parikka, Schneider, 2018, p.29). Examples are Media Archaeology Lab, Signal Lab and Media Archaeological Fundus. Emerson states, "All three labs, including the MAL, are driven not by a nostalgic impulse or a desire to act as mini-museums. Instead, we have all appropriated the science-based infrastructure of the lab for (anti) humanistic ends as we perform hands-on experiments with functioning media from the 19th and 20th centuries to discover what Ernst has called the 'time criticality' of each device." (Emerson, n.d.). The Media Archaeology Lab

> Founded in 2009 by Dr. Lori Emerson, […] is a place for cross-disciplinary, experimental research, teaching, and creative practice using one of the largest collections in the world of still-functioning obsolete media. Researchers, students, teachers, artists and members of the public are encouraged to turn on, open up, play and create with items from the collection that include phonograph players; magic lanterns; historic personal computers, handheld devices and game consoles including the Altair 8800b, Commodore 64, Apple IIe, Vectrex, and Imagination Machine I and II created by African-American video game pioneer Ed Smith (Media Archaeology Lab, 2025).

Jussy Parikka introduces some other examples of media archaeology labs, for example, "the pioneering media artist and technologist Erkki Kurenniemi's archive (in Helsinki) [that] produced infrastructurally interesting new solutions to cultural heritage — as well as new artistic work" (Jucan, Parikka, Schneider, 2018, p.30). In this laboratory and exhibition, the curator, Joasia Krysa, addresses curating art and sound exhibitions, transforming the narratives of curating through sonic practices in a laboratory setting for the exhibition space. Chapter 1, section 1.7, refers to this example. This example is interesting for this research because it represents a type of laboratory that works with sound but under the guidance of a curatorial experiment. The exhibition lab presents apparatus as archival material and remains from the artist Kurenniemi's collection. The re-installation and the work with the artist and musician's sonic apparatus in an exhibition space make this example a very experimental

type of media archaeology lab and exhibition. Indeed, it presents a hybrid way of showing, curating and preserving that can inspire sonic laboratory research.

Another example that uses archiving methods in an exhibition space is *Cabinets of Consequence* (2016), a work by sound artists Helena Hunter and Mark Peter Wright. The exhibitions re-situate and contextualise University College London's collections concerning ecological and technological evolution. In this work, the artists propose archiving practices as a method at the media archaeology lab. Parikka states,

> The exhibition picked up on the practice of cabinets of curiosities […] as one particular form of display. […] a productive disjuncture of histories of colonial collections and their contexts in contemporary exhibition space […] besides awareness of the colonial legacy, this provided an opportunity to put the objects into what they call 'relational dialogues with ecology, infrastructures, and media through the various powers that govern, claim and enact upon them. (Jucan, Parikka, Schneider, 2018, p.39)

The exhibition works with archival material that provides a new perspective on traditional cabinets, considering multiple factors such as colonialism and understanding media as a "multidisciplinary mediated knowledge about the environmental damage on a planetary scale" (Jucan, Parikka, Schneider, 2018, p.40). In this example, archiving adopts practices such as hands-on and contributes to a planetary, open, relational, and materialist approach connecting to media archaeology theory. In Parikka's words, the works in the exhibition are seen as "Temporal speculations [that] connect on a planetary scale" (Jucan, Parikka, Schneider, 2018, p.42). This concept is interesting for this research as it looks at media on a planetary scale. Understanding media through this dimension allows me to reconnect sound as a medium in the planetary context and rooted in material and temporal dimensions. These two concepts are analysed by media archaeology theory, and according to Parikka's perspective, all media collected as archival material in custody in media archaeology labs are considered (and analysed) under material and temporal conditions. According to media archaeology theory, time is not linear but embedded in physical practices, as the media apparatuses are constructed from materials resulting from evolutionary processes. All media is a result of geological time. Parikka understands materiality as a temporal dimension and proposes a new materiality that considers time non-linear and geological. Consequently, archiving in media archaeology labs must take this into account.

As suggested above, media archaeology works with all sources of media material, from computers to sound apparatus. So, I can propose that sonic archival materials can also be

analysed using time/material processes. Sonic laboratories can work as archives if they develop media archaeology theory/practices, as seen in Erkki Kurenniemi's example.

Media archaeology theory definition can be found in:

> writings from Erkki Huhtamo to Wolfgang Ernst, Friedrich Kittler to Siegfried Zielinski, Thomas Elsaesser and many [others] (…). However, media theory relates to notions of temporality as well: the various approaches are not only about material objects but how we think of (media cultural) temporality – media time that is recurring and based on topoi; the idea of deep times (Parikka, 2015, p.7).

According to Zielinski, deep time refers to "interactions between media, art, and science (that) have long roots" (Parikka, 2015, p.8).

Following these definitions, geological time is based on geological and palaeontological concepts. In Manuel DeLanda's words, "thousands of years of nonlinear history (…) expand to a geology of media art history: thousands, millions of years of 'history' of rocks, minerals, geophysics, atmospheric durations, earth times, which are the focus of past decades of intensive epistemological inquiry and practical exploitations as resources" (ibid.).

This definition allows me to rethink archives critically through a planetary scale, time, and material. Planetary, in the context of the thesis, will be proposed as a practice for field recording laboratories in Chapter 5. Planetary entails a more-than-human philosophy that operates inclusively and challenges standardised views of creation through sonic practices.

Moreover, archives and media archaeology consider working with sonic apparatus and other media from a broader, global, and planetary perspective. Because media archaeology focuses on the materiality of media, and thus also of sonic media. This can be understood as a planetary extension of resources. Media archaeology includes a planetary dimension when considering the global impact and reach of media and sonic technologies, which involves studying how these have contributed to geopolitical dynamics.

I understand this to have the possibility to implement the notion of a sonic laboratory that expands, as the media archaeology labs do, beyond the physical laboratory, and considers the planetary as a condition and context for analysing, studying, working with and exploring through materiality sonic devices.

The planetary scale proposes a new global and earth(l)y perspective of the media archaeology laboratory, and also simultaneously to the sonic laboratory. Planetary represents and comprises non-humans, minerals, and climate.

Media archaeology focuses on geological materiality as a notion that refers to the "results of a long process of a natural, historical kind (…) as a sort of a new materialist metaphysics

affects: metals have to be accounted as chemical catalysts" (Parikka, 2015, p.60). In Parikka's words, "Geology of media deals with the weird intersections of earth materials and entangled times" (Parikka, 2015, p.137). Therefore, one of media archaeology's contributions is the global perspective of processes combining ancient planetary material to develop technologically advanced tools (including sonic devices).

Chapter 5 of this thesis will create a planetary laboratory concept and idea. There, I will present examples of sonic laboratories that explore media and practices that consider the planetary, through practices such as field recording.

Media archaeology theory is based on a materialist perspective of the media (and sonic) technologies, but also uses the notion of time, more concretely, the notion of deep time. In other words, quoting Parikka, "Deep time of the earth: over three-million-year-old deposits of plants and animals from the dinosaur era" (Parikka, 2015, p.137) made possible what Parikka calls "scientific technological form(s)" (ibid.).

These forms result from highly technological developments, such as laboratories' manufacturing processes, where parts of the earth are transformed into scientific and technological developments. Sonic devices, apparatuses, and media are examples of these.

Parikka states there is a "continuum between cultural techniques and materiality of the earth" (Parikka, 2015, p.75). I understand this continuum to include sonic media materialities found in techno-cultural apparatuses fabricated and developed through laboratory processes. For instance, sonic media comprises plastics and chemical processes, such as in CDs, vinyl, and analogue/digital recorders. Moreover, the notion of temporality and materiality contributes to implementing the idea of the planetary to develop digital media and sonic apparatuses and a critical view of them.

I contend that the planetary scale allows the critical understanding of industrial laboratories as places for transforming materials into technoscientific artefacts. In Parikka's words,

> processes of photosynthesis, fossil fuels, and the now-increasing centrality of rare earth minerals as memories of geological durations but mined as an essential part of advanced technological information cultures - all these are part and parcel of the entanglement of the materiality of work and the long-term duration of the materiality of the earth (Parikka, 2015, p.98)

Thus, I contend that the planetary scale entails a broader, global perspective on studying the materiality of media (including sonic apparatuses) and is an extension of resources and geopolitical dynamics. Planetary is a new global and earthly perspective comprising non-

humans, minerals, and climate, considering geological materiality that intersects with deep time, as geological material has been produced through millions of years and processes.

The notion of planetary can contribute to re-evaluating laboratory processes/practices. I will discuss this idea more in Chapter 5. A “planet laboratory” will consider processes from resource exploitation to technological and sonic artefact deployment. I will explore how specific planetary practices, such as field recording, use sonic technologies to produce laboratory practices in planetary conditions.

An inclusive processual view of the laboratory may also adopt a critical perspective of technoscience development. Indeed, the planetary scale is a notion that may be inclusive as it carries an environmental understanding of the Earth. Moreover, contributions towards a more sustainable laboratory can be elaborated.

Highly industrialised processes in laboratories and other infrastructures have an environmental impact. In Parikka’s words, “refined electronics and their manufacture (require) detailed and laboratory-conditioned fabrication processes” (Parikka, 2015, p.100), which entails working with minerals. Understanding minerals and non-humans through deep time, which considers the "geological matter as living" (Parikka, 2015, p.35), formulates a possibility for laboratory practices more attuned to the global/ecological realities/relationalities. Geology is not dead matter. The Earth flows and is dynamic. Deeper materialities and deep time represent a critical discourse in front of resource exploitation and high-technological processes. Including non-humans and considering materiality, deep time, and planetary scale proposes an inclusive perspective and a critical view of laboratories' hegemonic and technoscientific production processes.

Media archaeology theory uses archiving in media archaeology labs, transforming them into dynamic spaces for experimentation, preservation, and creative practice. By shifting archiving from institutional places to hands-on, lab-based environments, media archaeology labs challenge traditional notions of preservation and curation. These laboratories analyse and study old media technologies, including sonic apparatuses, through understanding deep time and geological materiality. I contend that sonic laboratories can use archiving and experimental practices to consider the planetary implications of sound technologies. I see such a process, for instance, in Erkki Kurenniemi’s laboratory and examples shown in Chapter 5.

The planetary scale introduces a broader ecological, geopolitical and time perspective, positioning sound and media technologies within a global framework of resource extraction, material transformation, and environmental impact. Media archaeology’s focus on deep time and planetary materiality challenges dominant paradigms of technological development,

advocating for a more sustainable and inclusive understanding of laboratory environments. This critical thinking of media archaeology labs, and its impact on the particular possibilities of sonic laboratories, will be further explored in Chapter 5, where a planetary laboratory will be proposed as a model for integrating ecological consciousness into experimental sound practices.

Conclusion

In this chapter, I started by focusing on methods such as learning by doing, which arise from John Dewey's educational philosophy and belong to the academic laboratory. Academic laboratories are controversial spaces, sometimes part of the American model of university labs (see Chapter 1, section 1.2) or seen as more alternative spaces, with the study of academic sonic labs (see Chapter 2, section 2.2). In Chapter 3, using learning by doing, these academic labs incorporate hands-on and experimental educational practice and it incurs in the societal improvement becoming an engine of democracy (see Chapter 3, section 3.1) as stated by Beck and Bishop: "the laboratory of the new movement' situates education at the centre of innovative social and cultural production" (Beck and Bishop, 2020, pp.50-51). Consequently, sonic labs may benefit from applying learning by doing to develop societal improvements through their auditory creations.

Following that, I discovered that artists like Pe Lang employ experimentation in their creative processes (see Chapter 2, section 2.1.3), where he developed experimental mechanical sound objects (Pe Lang, n.d.). Beyond artistic exploration, experimentation is a sonic laboratory practice that challenges institutional knowledge production. Experimentation is considered a process (in Latour and Arrigoni), an open-ended situation which contributes to knowledge creation and meaning making through the enactment of audiences. Experimenting allows for curiosity and inspires curating, making curators conscious of their practices. Thus, curating and experimenting are applied in laboratories, proposing an exhibition model that centres on knowledge production as an open process (see Chapter 3, section 3.2: "the open-ended resolution in laboratory practice that Latour and Weibel present as a curatorial model inspired by the open definition of the laboratory" (Arrigoni, 2017, p.28)), including multiple curators and spectators as actants. This identification of curatorial practice as a laboratory practice will be studied further in Chapter 4.

Prototyping, introduced in Chapter 2 as a method for producing sonic devices, is further explored in Chapter 3 to develop apparatuses in hacklabs or, in other words, revolutionary mediated technologies promoting transparency, openness, and situated knowledge (see Chapter 3, section 3.3). These apparatuses influence the development of sound technologies,

instruments, and sonic laboratory methods. Additionally, examples such as the Agbogbloshie Makerspace Platform, The Maker Movement in Africa, and Shenzhen in Hong Kong demonstrate how prototyping fosters decolonial, critical, and ethical approaches to knowledge production in non-Western contexts (see Chapter 3, section 3.3). Prototyping brings to laboratories dynamic processes, collaborative, radical and critical practices, that produce philosophical tools. Moreover, prototyping has been considered a rebellion through hacking in the counter-culture community that facilitates sustainability and "critical thinking" (Papadimitriou, in Bradbury and O'Hara, 2020, p.207). Consequently, sonic laboratories can be seen to enhance their critical potential through prototyping practices when creating sonic objects and apparatuses.

This chapter also examined DIY, a "countercultural" (Kohtala and Ede, in Bogers and Chiappini, 2019, p.279) method (see Chapter 3, section 3.4). This allows me to rethink which laboratories represent an alternative to institutions. Examples of DIY practices that develop sound in laboratories include the exhibition *Sounding DIY* (see Chapter 3, section 3.4). DIY relates to producing apparatuses and technologies through "hands-on" (Kohtala and Ede, in Bogers and Chiappini, 2019, p.281) and self-made instruments, as in the case of Hugh Davies (see Chapter 1, section 1.7 and Chapter 3, section 3.4), which inspires instrument building in sonic laboratories. Indeed, laboratories that develop sonic apparatuses may benefit from working with methods such as DIY, as they offer practices against capitalist mass production that can reveal the potential of sonic laboratories. DIY represents a community of self-taught hackers, artists, coders, and others who are not affiliated with academia. Promotes anti-consumerism in a collaborative and collective project that organises participatory events and opts for degrowth politics. It is, indeed, sustainable, ethical and critical of consumerism and technological capitalism.

Through this chapter, I have also discussed that workshops and hackathons operate through "collaboration [and] emphasis on process" (Arrigoni, 2017, p.1). Hackathons and workshops put in place hackers' practices and influence and challenge curating, mainly due to collaboration. This will be explored next in Chapter 4, where I understand curating as applied in exhibitions/laboratories. I will determine whether curating laboratories enhances and tackles colonial/institutional behaviour in museum practices.

Workshops propose "making things together" (Arrigoni, 2017, p.2) to defy the more passive viewing outcomes of curating the museum. As seen in SARC (an example of sonic/academic lab shown in Chapters 2 and 3), hackathons are based on collaboration and "knowledge sharing" (Aedo, in Bradbury and O'Hara, 2020, p.203). These workshops can link with field recording sonic laboratories, which will be studied in Chapter 5, as they promote collaboration in workshops.

Workshops and hackathons represent the community of hackers, coders, and artists that operate through DIY, hands-on, learning by doing, and open-source. Both methods challenge curating through critical strategies, presenting “anti-disciplinary” (Bradbury and O’Hara, 2020, p.134) collective processes, which are transdisciplinary, inclusive.

Archiving is a media archaeology lab method that can influence sonic laboratories. Media archaeology labs include sound apparatuses in their media archival material and work based on “hands-on approaches, methodologies of tinkering, and collective ‘doing it together’ spirit” (Jucan, Parikka, Schneider, 2018, p.21). I have found that these radical practices can identify with the potential of the sonic laboratory, which defies, opposes, and criticises a more rigid and conventional corporative laboratory. Furthermore, archiving deals with “old objects” (ibid.) that need to be reconsidered as elements of materiality (see Chapter 3, section 3.6: a “continuum between cultural techniques and materiality of the earth” (Parikka, 2015, p.75)) on a “planetary scale” (Jucan, Parikka, Schneider, 2018, p.40). This allows me to investigate planetary laboratories in Chapter 5.

The findings of this third chapter suggest that sonic laboratories may incorporate methods from learning by doing to archival methods. This can bring radical strategies to understand the potential of the sonic laboratory, which can defy hegemonies and behave as a hybrid space, that entails the understanding of the laboratory as a complex and multiple space, but also acknowledging its interdisciplinary nature and practices of the (re-)mixing of mostly arts, sound, and sciences.

Through this chapter, I have found many examples of laboratories concerning curatorial practices and exhibition making, from experimentation with laboratories and curating in Latour's practices to Krysa's archival exhibitions. Therefore, in the next chapter (Chapter 4), I enquire whether it is possible to identify the positive aspects that the laboratory brings into curating to decolonise and propose a critical view of curating as a sonic laboratory practice.

Chapter 3 presents an analysis of various laboratory methods. In this chapter, I work broadly, not only on sound methods, but within different laboratories methods, because I need to understand the possibilities of the sonic lab, as my research question asks. In this chapter, one finding is the use of archiving as a method in media archaeology labs. This is of great importance, as archiving is understood within media archaeology, which considers technological artefacts (including sonic apparatuses) across planetary, temporal, and material scales. This enables me to consider the planetary laboratory, which will be developed in Chapter 5. However, I first need to address another practice that is important for laboratory methods, such as experimentation and workshops: curation, which will be analysed in Chapter 4.

4. Curating as a Laboratory Practice

Introduction

In Chapter 4, I explore curating as a method applied in arts laboratories and others of this kind. Curating that concerns laboratories could be considered an experimental or institutional practice. I examine the laboratory's potential for curating and how it can overcome hegemonies within museum institutions. For instance, I aim to demonstrate curatorial practices through historical examples, such as *Experiments in Art and Technology* (curated by Billy Kluver), *Aerial/Sparks* (curated by Louise Manifold), and the exhibitions I curated under the title *Sounding DIY* (curated by Laura Netz, my artistic moniker). In Chapter 4, I also investigate whether contemporary curatorial alternatives can challenge institutional curating practice, following discussions and analyses by directors, artists and researchers such as Barr, Steyerl, Holmes, and Szeemann, to name a few. As a method, I present three examples of exhibitions that address three concepts that help answer my research question: the sonic in relation to laboratories, mediated through curating. Here, I see curating as a laboratory practice that challenges imposed views and presents sonically centred works in gallery/museum environments. This is important to this thesis, as I find that curating is a discipline that enables new laboratory modes, such as the exhibition lab. Can curating as an experimental practice provide practical examples of managing sound art in laboratories and develop the potential of a critical sonic laboratory? In the following and final chapter, I explore alternative laboratory methods to address this problem.

This chapter continues my analysis of laboratory methods in the previous chapter, explicitly focusing on curating the laboratory as a critical space to enhance possibilities in sonic laboratories.

A previous reference to curating sonic laboratories appears in Chapter 1, in the Art Laboratories: Artists, Institutions, and Exhibitions section. There, I have written about Joasia Krysa, who presented *Erkki Kurenniemi (In 2048)* at Documenta 13 (2012), a curated exhibition about sound art that became interdisciplinary as other disciplines also interfered in the exhibition process. Moreover, in Chapter 3, I discuss curating as connected to other methods, such as archiving and some laboratory typologies, specifically in the media archaeology lab. The curated laboratory of Kurenniemi also appears in Chapter 3, where I describe how to display sonic archived material. This example entails working with sonic media and curating a type of laboratory exhibition that pushes institutional boundaries and appears as a transgressive example. This answers my research aim about the possibilities of sonic laboratories.

Curating is explored in this research as applied to the sonic medium and used in institutions, museums, and galleries. Analysing the status and practice of curating concerning laboratories has presented a dichotomy: situating curating at once as an institutionalised, traditional practice(understood as certain hegemonic narratives and forgetting/excluding others, still connected to traditional colonialism) but also offering experimentation and challenges to conventional curating.

This chapter connects with my thesis aim of investigating the potential of the sonic laboratory by exploring different curatorial strategies that link curating and laboratories. Firstly, I will explore the relationship between laboratories, museums, and curators in a contemporary art context. Secondly, I analyse curatorial practices developed through artists-in-laboratories residences. I will also present an example of a curated sound art exhibition I created in a laboratory setting, serving as a lab practice.

I begin this chapter on curating laboratories by analysing the relationships between laboratories, museums, and curators, providing an overview of curating practices that range from institutional to independent, and challenging traditional institutions.

Then, I study artists-in-laboratories residences, which, in their outcome, interfere with curating. To this end, in this chapter, I research curating artists-in-laboratories through two relevant examples: *Experiments in Art and Technology* (E.A.T.) and *Aerial/Sparks*.

In addition, I explore the series *Sounding DIY*, which entails three exhibitions in London (UK), Split (Croatia), and Folkestone (UK). *Sounding DIY* has appeared in Chapter 3 of this research, in the DIY section.

Investigating critical curatorial practices in laboratories can inspire a sonic laboratory model, proposing a hybrid model that results in being critical, inclusive and ethical.

4.1 Laboratories, Museums, Curators

This section initiates a discussion of the curatorial role in scientific laboratories, drawing on contemporary art examples to illustrate the relationships between laboratories, curators, and museums, thereby fostering a critical perspective on the laboratory. For this, I focus on contemporary art examples highlighting curatorial practices that take the laboratory as a model, especially in museums and art institutions. This helps me understand how the laboratory could be used as a model for curatorial practice.

One recurrent example that is always presented in the arts when discussing laboratories' influences in curating is the Museum of Modern Art, which was directed by Alfred H. Barr, who claimed in 1939 that "the Museum of Modern Art is a laboratory: in its experiments, the public is invited to participate" (Barr, in Arrigoni, 2017 p.14), and in Beryl Graham's words,

“Alfred Barr was describing the MOMA as a laboratory” (Graham and Cook, 2010, p.235). Barr directed many exhibitions in this ‘laboratory’ and was a key figure in helping to further the purpose of the Museum. He preliminarily transformed the process of artwork acquisition, opting for the artists' leadership, and not the museums. A change in curatorship that promotes the figure of the artist is prominent in the museography process; the artist leads the trends, and not the museum.

In this, I also follow the work of the artist Hito Steyerl, who describes the museum as a workspace, suggesting that the "laboratory definition" envisions the exhibition space as a site for showcasing art and where work occurs. In this context, the museum becomes a place where the public can actively engage and contribute to the creative process (Steyerl, cited in Arrigoni, 2017, p.23). Brian Holmes extends this concept by describing museums as "social laboratories" where visitors can encounter and experience new behaviours, emphasising the museum's role in facilitating social evolution (Holmes, cited in Arrigoni, 2017, p.23). Another alternative approach is that of Tony Bennett, viewing museums as "civic laboratories" that serve as platforms for encounters between objects and people, fostering cultural diversity and understanding (Bennett, cited in Arrigoni, 2017, p.23).

More definitions of the museum as a lab can be found by Charles Esche, the director of the Van Abbemuseum in Eindhoven, who envisions the museum as a multifaceted space designed for production, debate, and experimentation. He characterises it as a hybrid of a community centre, a laboratory, and an academy, with less emphasis on the traditional showroom function (Esche, cited in Arrigoni, 2017, p.23).

Another contemporary curator, Harald Szeemann, aligns with the concept of the museum as a laboratory. In an interview with Carolee Thea, he expresses his intention to open up the institution as a laboratory, highlighting the non-financial aspects of art and emphasising experimentation (Thea, 2001). Additionally, contemporary culture draws inspiration from science centres, like the Exploration in San Francisco and the Dana Centre in London, which have a history of involving artists in hybrid lab/exhibition settings, influencing the idea of the museum as a laboratory (Arrigoni, 2017, p.24).

In curating laboratories, there is a turn away from the traditional exhibition of objects, and independent curators transform themselves into artists, adopting creative methods. The exhibition can be seen as a sonic space where the curator acts as an artist. In Joseph Doubtfire and Giulia Ranchetti’s words, “the independent curator (or curator as an artist) uses the exhibition as a medium for creative expression and employs creative methods” (Doubtfire and Ranchetti, 2015). This way of curating challenges traditional curation in museums, institutions, and laboratories, making exhibitions more critical, self-reflexive, and

processual. The curators become artists while exhibiting; the term artistic is described as “a creative disposition” (ibid.). Therefore, curating can be understood as a sonic practice that artistically establishes relations of meanings, objects and functions. Curators apply curatorial practices to laboratories that offer residences for sound artists. These curatorial practices can inspire the work of a curator in a laboratory environment.

In the following sections, working from these examples, I examine different laboratories that host artist residencies/collaborations in the light of curatorial possibilities.

4.2 *Experiments in Art and Technology (E.A.T.)*

Experiments in Art and Technology (E.A.T.) results from an artist’s residency in the well-known laboratory of Bell Labs. Chapter 1 shows it as an example of an industrial laboratory and a possible origin of the sonic laboratory. Bell Labs worked primarily with sound reproduction techniques, facilitating its dissemination and research. Here, I discuss the participation of artists in residence, which was mediated through the figure of the curator Billy Kluver. Through E.A.T., artists developed works during their stays at the Bell Labs. Some of the outcomes were exhibitions, and it is paramount for this section to explore relations between sound, artists, curators, exhibitions, and laboratories to demonstrate the sonic possibilities of the laboratory. This is essential as it becomes an example of curating sonic laboratories. As seen in Chapter 1, Bell Labs is considered the possible origin of sound laboratories, and here, I will analyse the potential that curating sound has in transforming the laboratory into an inclusive, hybrid, critical and sonic space. Artists-in-laboratory residences started to develop in the 1960s when artists approached corporate laboratories such as Bell Labs. After the 1990s, the participation of artists in laboratories increased as the laboratory typologies of medialabs, hacklabs, and makerspaces started appearing. These laboratories followed the traditions that began in the 1960s and continued experimentation with artists in residence. Examples are "MIT Media Laboratory, Xerox Parc PAIR artists in residence program, and the Banff Centre." (Century, in Arrigoni, 2017, pp.19-20). These laboratories have a strong connection with what was named the military-industrial complex, as seen in Chapter 1, though, as referred there, and through artists in residence programs, these see their results enhanced by enabling certain artists, scientists and curatorial possibilities, which delineate a lab-based curatorial practice.

According to Beck and Bishop, discussing the E.A.T. residency programme at the Bell Labs,

> in conjunction with a 1968 MOMA exhibition called *The Machine as Seen at the End of the Mechanical Age,* E.A.T. ran a competition for art-tech collaboration. The following year, 140 proposals were exhibited at the Brooklyn Museum in an

> exhibition called *Some More Beginnings: An Exhibition of Submitted Works Involving Technical Materials and Processes*. (Beck and Bishop, 2020, p.97).

This quote exemplifies the potential of E.A.T. to not only do laboratory work but to curate exhibitions. E.A.T. was founded on the relations that artists established through laboratory residences. Johan Wilhelm "Billy" Kluver was one of the E.A.T. cofounders in 1966. One of its inceptors "started at the personal level, writing essays for art catalogues, helping organize exhibitions, and partnering one-on-one with prominent artists" (McCray, 2020, p.9). Kluver was interested in the relations between arts engineers and thus proposed that Bell Labs initiate residencies between the laboratory and the artists. He helped to curate what could be seen as "creative interventions" (McCray, 2020, p.78), such as events, exhibitions, and concerts, which brought the laboratory work into a social realm. With collaborators such as Allan Kaprow, Jasper Johns, Andy Warhol, and Robert Rauschenberg, Kluver experimented with different formats putting together artists and engineers at Bell Labs, "the best industrial research lab in the world" (McCray, 2020, p.84) at that moment: "Throughout the 1960s, buoyed by AT&T's profits, the lab supported a small coterie of artists-in-residence, such as Nam June Paik, James Tenney, Lillian Schwartz, and Stan VanDerBeek." (Pierce, in McCray, 2020, p.85).

The outcomes of these residences were applications for electronic speech synthesis, computer-generated images, and music compositions. These events and exhibitions were curated as creative outputs from the artists-in-laboratory residences. As an engineer at Bell Labs, Kluver was interested in the relations that art and technology offered as a solution to social problems.

Kluver cofounded E.A.T., and also one of the art-and-technology E.A.T. curated events, *9 Evenings: Theatre and Engineering*, an interdisciplinary creative process, showing "dance, music, film, sculpture, and the visual arts" (McCray, 2020, p.101). Visualised as an experiment between artists and engineers, Kluver invited different artists, composers, dancers, choreographers, and engineers at Bell Labs, with people such as John Cage, David Tudor, Steve Paxton, Lucinda Childs, Deborah Hay, Robert Rauschenberg, and Yvonne Rainer, among others. The event was curated at the Armory in Manhattan, New York, a military structure in a "massive three-story building" (McCray, 2020, p.109) and "33,000 square feet of floor space" (ibid.), which could fit easily "Several thousand people" (ibid.). The event presented different "performances as experimental investigations" (McCray, 2020, p.125), showing artist-engineer collaborations. In this sense, *9 Evenings* represents an example of the curatorial skills required to organise the collaboration between scientists and artists in laboratories.

E.A.T. facilitated artists' access to Bell Labs to develop the works in *9 Evenings*. Artists were offered access to new technologies and engineers' technical skills to build their works. In this sense, "Kluver publicly proclaimed E.A.T. […] as a 'transducer between the artists and the industrial laboratory'" (Kluver, in McCray, 2020, p.131). According to McCray, artists were "accessing tools like computers, semiconductors, and lasers as well as even newer technology that was still in 'the lab stage'" (McCray, 2020, p.133). E.A.T. provided "creative stimulation for engineers" (McCray, 2020, p.135). This way of promoting the laboratory as a creative/sonic place through curatorial activities could be used to frame the laboratory as a place for engineers and engineering as a practice with similar aspects to arts: "The engineer and the artists have many things in common; most importantly the creative urge" (Nathan, in McCray, 2020, p.137). The creativity of laboratories was explored in Kluver through the management of E.A.T., which proposed a series of curated events such as *9 Evenings* and other exhibitions.

The E.A.T. example also incorporates work with sonic media. Examples are the work of John Cage, who presented *Variations VII* at *9 Evenings*. This work entails the potential to exhibit sonic media in a lab-type and curatorial event resulting from the collaboration between sonic artists and engineers at Bell Labs. *Variations VII* was developed “With contributions by: Merce Cunningham, Billy Kluver, David Tudor, Bob Moog, Cecil Coker, Rudy Kompfner” (9 Evenings: Theatre and Engineering, 2006-2008). During the 85 minutes that the performance lasted, the audience listened to “sound sources [but] only those sounds which are in the air at the moment of performance. […] sounds from all over the city and if possible all over the world. He also wanted to pick up the sounds from outer space” (ibid.). To create such a performance, John Cage “explore[d] new ways to use a given instrument or technology. He never limited himself to the accepted rules” (ibid.). This critical aspect relates to what my thesis is searching for: the potential of sonic media in laboratories to challenge institutionalised spaces. John Cage worked with a white noise generator and ten dedicated telephone lines from the New York Telephone network. Then, “John chose ten places around New York City to call and leave the phones off their hooks during the performance. Magnetic pickups attached to the receivers fed the sounds into the sound modulation system devised by David Tudor” (ibid.). In addition to the noise generator and the telephone lines,

> John also had 6 contact microphones on the performing platform itself and 12 contact microphones on household appliances such as a blender, a juicer, a toaster, a fan, etc., as well as electrodes on one performer to capture brain waves. He also had 20 radio bands, 2 television bands, and 2 Geiger counters. Oscillators and pulse generators complete the sound sources (ibid.).

The electronic sound component in the performance needs to be added to the light component, which allowed:

> Another performance element in *Variations VII* was the use of photocells to trigger sounds off and on. Thirty photocells were mounted on the performance table pointed at strong lights placed at ankle level around the performance area. As the performers moved up and down the platform, they broke the light beams and triggered the sound sources which were processed by the system and fed to 217 outputs: 12 stationary speakers in the balcony, 3 speakers on the Armory floor, David Tudor's horn speaker, and 1 speaker in the ceiling (ibid.).

All this equipment makes the performance an example of radically exploring sonic media. The experimentation and DIY elements transform this sound work into a laboratory-type collaboration with an exhibition/event, turning it into a reference for understanding sonic laboratories, which, in this case, explore the possibilities of the sonic media critically and approach technology from a different position:

> The point about John Cage's involvement with technology is that although he has always been quick to use new means of making sound, he stands outside technology. He is not involved as many are today, in working with electronics, building devices and shaping them to produce sounds. Rather, John Cage continues to explore the extent to which a given means can be used for the greatest freedom, variety and pleasure (ibid.).

Moreover, others have also pointed out this aspect in Cage's performance of the performativity of sound and the capacity to transgress or radically and unconventionally explore sound:

> In *Variations VII*, John Cage applied the principle of randomness to select the materials for his performance, but did not use any recorded audio tracks. He tried, rather, to make audible, at one and the same place, sounds issuing simultaneously from a variety of sources. With this in mind, he made use of communications media like radio and telephone to amplify phenomena already present in the environment of the Armory (Fondation Langlois, 2019).

I view this work as a model for overcoming limitations in both live performance music and exhibition curation, particularly in incorporating environmental elements. It incorporates urban environments and cityscapes that can also be soundscapes, creating continuity between inside and outside. Ultimately, it is a radical performance that serves as a referent for sonic laboratories' outcomes and processes. In Cage's words, the result was "a situation different than anyone could have pre-imagined" (John Cage, n.d.).

Transgressing technology and sonic media in a laboratory/exhibition type of event, Cage and *Variations VII* at *9 Evenings* by E.A.T. and Billy Kluver, can be referenced for developing and understanding the behaviour of sonic laboratories that have the potential to approach curating sound critically.

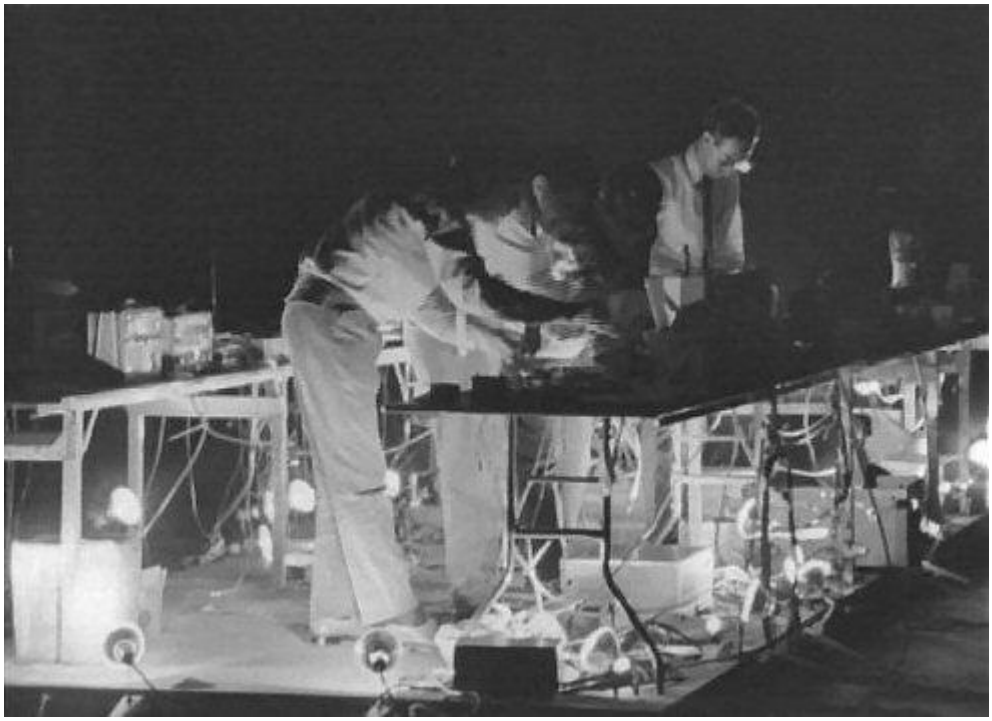

Fig 5. John Cage, *Variations VII*, Copyright The Daniel Langlois Foundation for Art, Science, and Technology, 9 Evenings: Theatre and Engineering Fonds.

In 1967, Kluver started to secure financial support from industry corporations such as IBM and reunited “wealthy industrialists, gallery owners, museum executives, and prominent art collectors to serve on E.A.T.’s board of directors” (McCray, 2020, p.144). In October 1967, Kluver organised and curated another of the E.A.T.’s events. It was a show at Rauschenberg’s East Village studio, and 300 invitees “mingled with artists, engineers, and curators” (ibid.). Kluver could be proposed as an engineer contributing to imagining curatorial strategies for engineers and artists-in-labs collaborations.

Continuing to grow, E.A.T. "started to explore how the partnership between artists, engineers, and other communities might catalyse 'cultural revolutions'" (McCray, 2020, p.150). Moreover, in doing so, E.A.T. searched for collaboration with the Real Great Society, formed by activists from the Puerto Rican community. Kluver, with this association, saw how laboratories could be a place for "social and technical experimentation" (Kluver, in McCray, 2020, p.151). Therefore, as an engineer who worked at Bell Labs, Kluver's vision of laboratories was dynamic, social, and creative, bringing

artists into the lab and taking the lab to the artists' place. In these dynamic relationships, Kluver could contribute to exploring the curatorial possibilities of the laboratory by curating many events, such as *9 Evenings*, and facilitating the expansion of artists' and engineers' collaborations.

Continuing with the commissions E.A.T. received, there was "the American Pavillion for the Osaka World's Fair, Expo'70" (Beck and Bishop, 2020, p.97), commissioned by PepsiCo. With these activities, Kluver promoted a curatorial practice that involved curating events and world fairs that may precede contemporary biennials. Although Kluver and E.A.T. employed curatorial skills to produce exhibitions from a more centric museum perspective, their approach to transforming the works of artists and engineers in laboratories for public display can be seen as a pioneering method of curating laboratories. Kluver experienced financial hardship during the creation of the Pavillion, as PepsiCo withdrew the funding. These experiences organising art events with engineers could demonstrate how "E.A.T. was an experiment in the organisation" (Beck and Bishop, 2020, p.98).

Experimentation as a laboratory method, observed in Chapter 3, presents examples of curatorial possibilities, as seen in Latour's exhibition examples. Here, experimentation links again with curatorial practices. Experimentation in curating events led Kluver and E.A.T. to place "open-ended inquiry (and a little) defined outcome" (Beck and Bishop, 2020, p.99). Kluver's organisational strategies relied upon an experimental dimension but also on collective work, proposing a creative turn towards curatorial practices and laboratory spaces.

Another contemporary example of curating artists-in-labs is the project *Aerial/Sparks* presented in this research through the case study of Robertina Šebjanič (Chapter 2 of this thesis) and reviewed as an example of curating laboratories in the next section of this chapter.

4.3 *Aerial/Sparks*

The second example is *Aerial/Sparks*, an exhibition that results from the artists' residency in a science laboratory. Chapter 2 introduced this example as part of the analysis of sonic artists in science lab residences. I will discuss curating sonic media and sound, and connecting exhibiting with laboratories. *Aerial/Sparks*, the exhibition resulting from the artists-in-laboratory residence at the Marine Institute Ireland, an onboard-vessel type of laboratory curated by Louise Manifold, is examined in this section as a curatorial practice where the figure of a curator mediates artists in laboratories, and which incorporates a notion of inclusion working directly with artists, and avoiding impositions from traditional curating.

Aerial/Sparks is an exhibition resulting from an artists' residence at the Marine Institute Ireland's RV Celtic Explorer, a laboratory to study ocean phenomena. Among the artists that

participated in the residency are Ailís Ní Ríain (IRL), Carol Anne Connolly (IRL), David Stalling (DE), Kennedy Browne (IRL), Kevin Barry (IRL), Magz Hall (EN), and Robertina Šebjanič (SI). As a result of the residency, the artists contributed to developing artworks curated and exhibited by the *Aerial/Sparks*' curator, Louise Manifold.

The exhibition presents sonic works developed in the laboratory residency, which intersects with my research as it has components of curating sound in laboratories. This chapter searches for the connection of these three components to highlight the sonic possibilities in laboratories.

Situated in different venues across Inis Oírr, the smallest of the Aran Islands (Ireland), the exhibition was located in venues such as Áras Éanna, Inis Oírr Lighthouse, Inis Oírr Church, and The Handball Alley. The exhibition presented sound works that explore the ocean wilderness. Moreover, as an addition to the physical exhibition, the curator dedicated a virtual programme of events for a virtual exhibition in collaboration with Ars Electronica 2020 titled Garden GALWAY, which included events such as a presentation of electro-acoustic works and conversations between artists and marine scientists. *Aerial/Sparks* is a clear example of the relationship between curating, laboratories, sound and artists.

The exhibition presented the works of the following artists who use sound as a medium:

Ailís Ní Ríain´s *East-West: Where Morning is the Sea* is a video and sound composition that shows the artist's experience in the laboratory on board the RV Celtic Explorer,

> I composed the piece to the film's timeline, closely shaping the sounds in parallel with the visuals. The musical composition includes snippets of hummed songs together with a wide variety of sounds created inside a grand piano – percussion, slides, plucked strings, snippets of melody and keyboard sounds. All sounds – with the exception of the voice – come from one piano" (Aerial Sparks, n.d.).

The artist "aims to produce work that challenges, provokes and engages" (ibid.) while testing boundaries in music composition and sound practice. This is an essential factor, where composition and music, as well as aesthetics, have been explored as a dimension of sonic laboratories (see Chapter 2 section on Sound in Academic Labs) that can enhance the possibilities to transgress normative curating and normative/hegemonic laboratory practices. In this sense, it is an example of the potential of laboratories that apply sound through curating for this thesis. Moreover, the artist also points out the interdisciplinarity promoted by sound:

> I've often thought that scientists and artists have much in common, especially with those of us exploring sound. In fact, I suspect there are many

> scientists who might well be more creative than some artists. Society requires both innovative scientists and innovative artists to drive forward new ways of thinking, doing, making and living (Ailís Ní Ríain, n.d.)

This enables me to discuss sound specifically in the context of curating laboratories that promote sound-centric works. Moreover, sound's interdisciplinary relationship between artists and scientists facilitates collaboration in sonic laboratories.

Fig 6. Ailís Ní Ríain in the laboratory on board the RV Celtic Explorer, Copyright Garden GALWAY, 2020.

Carol Anne Connolly, *Answering Echoes,* 2020, ambisonic sound installation. This work facilitates the creation of sonic and visual work from the technological apparatus in the laboratory location, specifically "Utilising INFOMAR's three-dimensional representations of the Irish seabed, generated by multi-beam acoustic technology" (Aerial Sparks, n.d.). The laboratory's technological equipment is used to create this ambisonic composition that narrates the possibilities of technology, but aesthetically, "At INFOMAR, we use soundwaves to map the seafloor. Sound is emitted from transducers on the vessel, which

travel through the water column and are returned after they ‘echo’ off the bottom. This information is then translated into bathymetric maps” (Infomar, n.d.). The specificity of sound allows technicians and artists to create work that facilitates understanding and knowledge of the sea environment. Curating the sonic possibilities of the laboratory and developing the sonic works in *Aerial/Sparks* reveals technical capacities to understand and approach unknown environments.

David Stalling’s *Palace of Ships*, 2020, multi-channel sound, moving image. The experience on board the laboratory with scientists' expertise allows the artist to create a unique sonic work using seismometers and sea flow data. The resulting work also uses field recordings and the reading of a poem (through voice recording). Altogether, there are anthropogenic, biophonic, and geophonic elements. The perception of sounds on the ship, the vibrations of the earth, wind, water, and underwater sounds are recorded using highly sensitive mics attached to the ship's structure (contact transducers), field recorders and seismometers. Listening to these sounds results in a ‘magic experience’. Listening to the profound impression of seismometer signals and the earth's rumbles (that cannot be described with a formula but can be heard) allows artists, scientists and listeners to discover new things. The soundscape creates a fantastic listening experience that will enable you to find new approaches to unknown environments. The uniqueness of the opportunity that the artist has in the laboratory to play with uncommon and specific technological tools creates a different listening experience. This becomes an environmental experience understood through a multichannel and ambisonics installation that allows listeners to focus on the physicality of the bodily experience combined with the earth vibrations, but expressing a state of uncertainty (Aerial/Sparks, n.d.). With this work, the artist is interested in connections between music and environmental sounds, allowing planetary listening (this connects to Chapter 5, Planetary Laboratory, about field recording).

Other artists in the exhibition presented works influenced by their stay at the laboratory. However, they were less technically/technologically influenced, perhaps more critically focused on the properties of sound to explore different aspects of the residency. Examples are:

Kennedy Browne, *Island Affinities*, 2020. It is a collaboration piece with “Sean-nós improvisation in music and dance” (ibid.). The artist worked with “methods of audio recording and with the medium of radio as a form of transmission” (Galway 2020, n.d.). Browne is also interested in collaborations between disciplines.

Magz Hall, *Waves of Resistance (Radio art without borders). Tonnta Friotaíochta (Ealaíne raidió gan teorainneacha).* Installation with six radios transmitting a looped sonic work,

2020. It is a sonic work created at the laboratory residency on board the Celtic Explorer. The artist also made “an audio diary of my time at sea last year on the Celtic Explorer, a passage from Galway to Hamburg” (Hall, 2020). The artist uses sound to highlight the importance of radio apparatus in different environments.

Robertina Šebjanič, *Selachophilia: Cetorhinus maximus - Limaria hians,* sound installation, 2020. It is explored in this research in more depth in Chapter 2. It is a sonic work that uses field recordings from above and below the sea and represents the potential to use sound in laboratories as an outcome of residencies. It is also an example of curating sonic laboratories.

Kevin Barry, *Island Time,* 2020. Written and performed at Inis Oírr Lighthouse by Kevin Barry. Sound design and Foley by Jean McGrath and film by Louise Manifold. Kindly supported by the Commissioners of Irish Lights. It is a narration piece, again a sound-centric work “With elements both of radio play and of digital theatre” (Aerial/Sparks, n.d.).

The curatorial work in this exhibition, which groups and selects these different artists within the sound medium as a common component, highlights the more technical approach and the inclusion of elements such as voice recordings and narration. The importance of field recording, too, as sound work resulting from the residency curated within this exhibition, has inspired this research to investigate field recording in relation to the laboratory. This creates a much broader environment and context for the laboratory, which I name the planetary laboratory. This is developed further in Chapter 5.

The observations of this chapter demonstrate that in laboratories where artists participate in residencies, the curator's role is essential in facilitating relationships. In the case of the Marine Institute Ireland's onboard laboratory residency program, the curator serves as the vital link between the artistic and scientific realms, playing a central and pivotal role not only in the residency's initial conception but also in its ongoing development and potential outcomes.

Curator Louise Manifold assumed a multi-faceted role for the *Aerial/Sparks* project at the Marine Institute Ireland. Her methodology was to integrate artists into the laboratory environment, and her responsibilities extended to overseeing the entire project, working together (with)in the residency, and preparing the final exhibition.

One of Manifold's aims was to connect the Galway European Capital of Culture program for 2020 with the Marine Institute Ireland, which owns the marine research laboratory, the RV Celtic Explorer. The curator's vision was for artists to collaborate with scientists and produce newly commissioned artworks and installations that coincidentally use sound as a forceful

medium. The curator worked with seven international artists and organised their three-week stay aboard the research laboratory.

The curator's tasks and duties involved the logistical organisation of the residency, including facilitating the artists' presence on the laboratory vessel. Manifold also managed the project's outcomes, culminating in an exhibition. This exhibition presented different sonic projects. It incorporated non-art spaces, moving away from the traditional 'white cube' gallery setting, for example, “a lighthouse, the local church, an old handball alley” (Galway 2020, n.d.).

In this way, Manifold expressed a keen interest in connecting scientific explorations with art projects. She saw these collaborations as enriching experiences that allowed artists and scientists to engage in interdisciplinary practices. In the laboratory environment, the exchange between artists and scientists promoted the creativity of primarily sonic works: “Using the concept of sound and the sea is a unique way of showing how both the arts and sciences can come together to highlight the value, opportunities, and societal benefits of our ocean” (ibid.)

The curator's role in the *Aerial/Sparks* project at the Marine Institute Ireland was central to the exhibition's inception and evolution. Through curating laboratories, it contributed to a transformative collaboration between artists and scientists and offered a more inclusive and interdisciplinary approach to sonic exploration.

Curators are active agents mediating artists, laboratories and places to exhibit. The flexibility they promote and the promotion of sonic works in the *Aerial/Sparks* exhibition provide an example for understanding the potential that sonic laboratories can have through curating. Moreover, E.A.T. and *Aerial/Sparks* are examples of laboratory residences with exhibitions as outcomes that present/showcase sonic practices, an element that differentiates sonic labs from other labs.

In the next section, I present a sonic project I curated, which involved three exhibitions and their accompanying events. These were primarily sonic-centric outcomes of research into DIY in sonic practices, inspired by the laboratory as a place of transformation and knowledge dissemination.

4.4 *Sounding DIY*

In this project, I curated and researched to renew the perspective on curating sound, influenced by the relationships between art, science, and technology, but with a different approach to technology, tackled from the standpoint of DIY practices and media archaeology theory. This curatorial project motivates my investigation into sonic laboratories, and *Sounding DIY* consists of three significant events:

- 2017 *Sounding DIY*, Chalton Gallery, London.
- 2018 *Sounding DIY II*, Split, Croatia.
- 2019 *Sounding DIY III*, HOP Projects, Curatorial Residency, Folkestone, UK.

This exhibition can be understood as a sound-curated laboratory. With this, I propose that there is a type of exhibition that, when curated, becomes a laboratory of sound. This definition is inspired by the *exhibition lab*, seen in Chapter 1, section Art Laboratories: Artists, Institutions, and Exhibitions, where I refer to Toloudi's definition to explore experimentally the exhibition space.

The first exhibition in the series, *Sounding DIY*, highlights DIY practices versus capitalist mass production. The exhibition represents a substantial change in the creation of prototypes of musical instruments and sound objects in our contemporaneity. *Sounding DIY* works with almost thirty artists in DIY culture, promoting the efficiency of results obtained aesthetically and ideologically by designing musical instruments and sonic objects. This exhibition tries to foster a community of artists, tool developers, and creative professionals interested in supporting and understanding sound art practices developed with technology. The artists showcased were David Bloor, Tom Mudd, Tom Richards, Andrew Rowe, Noise Orchestra, Signal to Noise, and Taro Yasuno.

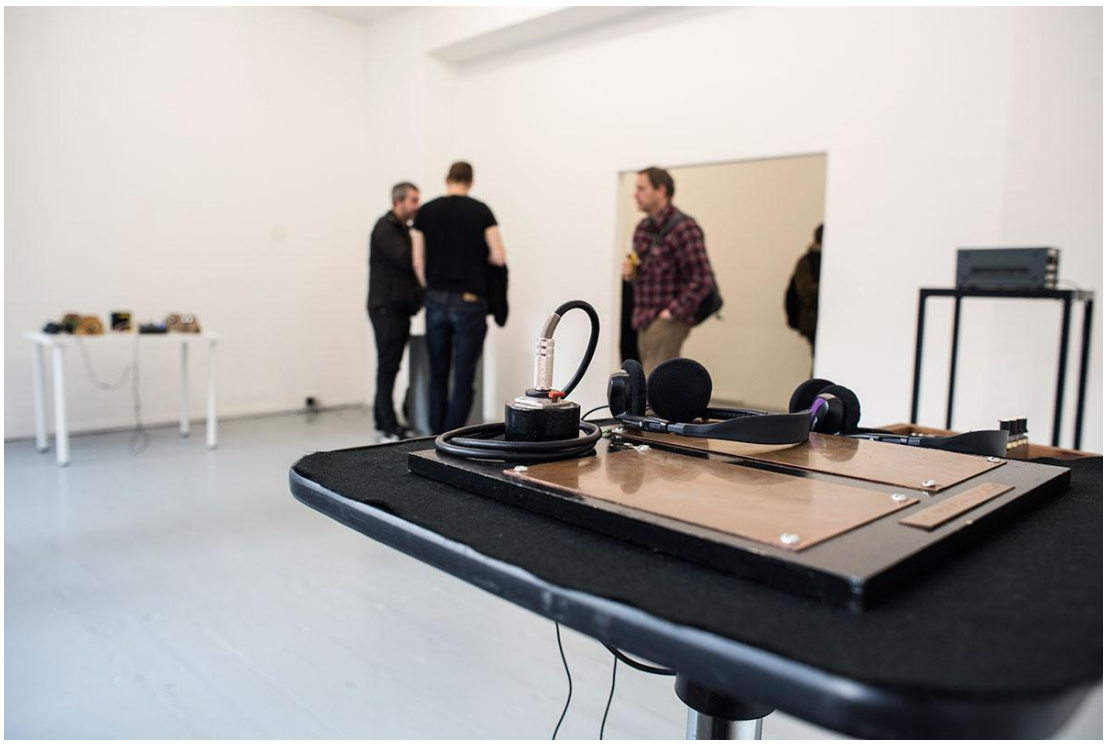

Fig 7. *Sounding DIY* exhibition view. Copyright Pau Ros.

The exhibition *Sounding DIY* was curated with a number of different strands and events: a series of workshops and live concerts. The exhibition is inspired by laboratory methods explored in Chapter 3: Hackathons and Workshops, which will enable a different perspective on curating, not only objects in the white cube – considered traditional curating – but also the initiative to invite audiences to participate in workshops. The live concerts add another dimension of music to better understand the exhibition as a totality: to transform sound into art.

The concerts took place at Cafe Oto (Dalston, London) and IKLECTIK (Waterloo, London), and included very different artists, musicians, alongside coders: Claude Heiland-Allen, Eden Grey, Suso Flores + Crowley Engel II, Bioni Samp, Prolonged Version, Toni Quiroga, Optonoise, TMS, xname, and Richard Crow. Focusing on the experimental side of electronic music, through the concerts, I wanted to express and communicate the possibilities of self-made instruments and open-source software in music. These conditions align with three concepts I am reviewing in this chapter: the laboratory influence (through DIY, workshops and experimentation as laboratory methods) with(in) curating sound.

The workshops were also curated following these three concepts. With the collaboration of the music venues IKLECTIK and Cafe Oto and the artists Toni Quiroga and Dirty Electronics, my curatorial project/work demonstrated how to turn parts of e-waste and trash into functional primitive sound devices inspired by media archaeology labs' methods.

In 2018, *Sounding DIY II*, Split, Croatia, presented Claude Heiland-Allen, Bioni Samp, Noise Orchestra, Tin Dožić, Hrvoje Hiršl and Davor Branimir Vincze. There was also:

– Record Label EAM (elektronische-art-and-music), CD-Rom, eleven tracks for the exhibition *Sounding DIY* (headphones, media player) Link: https://soundingdiy.wordpress.com/2017/02/27/202/

– Catalogue of the exhibition, *Sounding DIY*, showing artists in the exhibition, London 2017. Link: http://netzzz.net/wp-content/uploads/2017/03/Sounding-DiY-Catalogue-Digital.pdf

The exhibition was co-curated with Darko Fritz. There are elements of DIY and reverse engineering, such as media archaeology practice, used in laboratories. In Claude Heiland-Allen's work, *Puzzle,* 2008-2018, an audio-visual installation:

> In the Puzzle presented here the computer is manipulating the tiles. No malicious design, but insufficient specification means that no solution can be found; the automaton forever explores the state space but finds every way to position the tiles as good as the last… Each tile makes a sound, and each possible position has a

> processing effect associated with it. Part of the Puzzle is to watch and listen carefully, to see and hear and try to pick apart what it is that the computer is doing, to reverse-engineer the machinery inside from its outward appearance (Mathr, n.d.).

Bioni Samp's work, *Electronic Beesmoker Hiv Synthesiser*, 2018, also contains DIY elements. It is made with metal, wire, leather, plastic, and copper cables and is defined by the artist as a "Found object (Beesmoker) with internal home-made 'Hive Synthesiser'" (Samp, n.d.).

The exhibition was placed at MKC, an alternative art space located in the city of Split, Croatia: "The Multimedia Cultural Centre is an institution for organizing and presenting cultural and artistic programs in visual, film, music, and performing arts, which nurtures and promotes intermediality, interdisciplinarity, multimedia, experiment, and innovation." (MKC, n.d.). The spirit of the art centre inspired the curatorial project to be transversal, also facilitated by the incorporation of sound artists. The philosophy surrounding the exhibition promotes media archaeology theory, as applied in media archaeology labs as inclusive places where to reinvent a common idea of the laboratory. Moreover, these sonic works use DIY and reverse engineering as laboratory methods that enable the recreation of a curated 'sonic' exhibition concerned with institutional processes in technology production and promote thoughts about the beneficial aspects of sound art in front of corporate music.

Fig 8. *Sounding DIY II*, 2018, Split, Croatia, Tin Dožić. Copyright Laura Netz

The third event in the series, in 2019, *Sounding DIY III*, at HOP Projects, an experimental art gallery in Folkestone, UK, resulted from the process of a curatorial residency. I was invited to stay and develop the exhibition, which consisted of presenting different artists around the theme of Vitalist Materialism. The artists in the exhibition were Claude Heiland-Allen (projection), Stephen Cornford (print), xname (sculpture or noise bots), BJ Nilsen (audio installation), Erin Sexton (video), and Greg Orrom Swan (video). There were performances by artists such as Mother Disorder and Lou Barnell, and I also played under the moniker Laura Netz.

The exhibition shows artists in handmade culture, music, sound art, art and technology and digital media. It focuses on the practice of hackers and makers at the intersection of art, science, and technology, highlighting sound art and music production. The development of musical prototypes within the artistic sphere is presented as a contemporary paradigm that transforms the inertia of the capitalist system with hacked prototypes. In this change of production logic, the art/music relationship presents the sphere of techno-capitalism as an unsustainable and abusive threat. In the exhibition, we collaborated with artists who developed musical instruments to offer solutions to the current production system. This exhibition includes the works of artists and collaborators, among other participants. It invites different artists and collaborators to think about environmental and sustainable media art practices related to mining, DIY, and hacking OS/OH. Moreover, the exhibition presents the sound installation by BJ Nilsen, UGOL, which is part of a larger project called ORE, an art project revolving around mining and its impact on society and cultural relevance. UGOL touches upon the logistical side of coal: travelling by train via Murmansk. This field recording project connects mining with the planetary laboratory and with media archaeology concerns in showing the process of technological manufacturing. Outdoor field recording, as a sound practice developed in laboratories, will be explored further in Chapter 5.

Fig 9. *Sounding DIY III,* BJ Nilsen sound installation. Copyright BJ Nilsen.

The relationships that *Sounding DIY* brings as a curatorial project that uses field recording, DIY, reverse engineering, handmade OS/OH, and media archaeology allows me to rethink curating sound in terms of laboratory environments, and as noted previously- not only science spaces are named as laboratories, there are also artist spaces and exhibitions, which can function as laboratories. This example enables me to connect the three concepts, curating, sound, and laboratories, to understand the beneficial aspects that answer my research questions on the possibilities of sonic laboratories.

Conclusion

This chapter analyses curating as a laboratory practice. It includes examples of institutionalised practices and challenging curatorial practices that oppose traditional museum curators.

I started off by examining the relationship between laboratories, curators, and museums and showed how this revealed the laboratory models' influence on contemporary curatorial practices. The concept of the museum or exhibition space as a laboratory offers new perspectives on exhibition design, audience engagement, and cultural diversity. This idea of the museum as a laboratory is reflected in recent attempts to create laboratory spaces within established institutions, influenced by science centres and their history of exhibition settings.

From there, I explored sonic-mediated exhibitions assembled in laboratory environments, such as E.A.T. curated by Kluver, and collaborated with activists, which moved him away from military and governmental funding, opting to use creative curating. Kluver's curatorial practices can be referred to as a pioneering way of curating laboratories through experimentation, which is applied in curating and collaborating with activists through critical practices. Moreover, E.A.T.'s collaboration with John Cage and the Bell Labs engineers is a critical example of curating sonic laboratories. The work *Variations VII* by Cage represents an example of a sonic laboratory curated critically that enables the transgression of normativity in music listening and sound art experiences.

Through this chapter, I find evidence that artists collaborate in laboratories through residences, and this allows me to analyse which curatorial practices enable artists-in-laboratory residences. Indeed, the laboratory residence offers artists a space for research, to develop a project and a place to show the work produced during the residency. I have encountered curating practices proposing laboratory exchanges through residences for artists, which adopt a more experimental and engaging practice, collaborating with artists and suggesting new ways of presenting outcomes, such as *Aerial/Sparks*, which distances itself from the traditional white cube exhibition space to operate in new spaces such as the lighthouse or the local church. Collaboration between scientists and artists is another

component that highlights aspects of curating sonic laboratories, as observed in the *Aerial/Sparks* exhibition. Furthermore, with the work of David Stalling's *Palace of Ships*, the artist becomes interested in the sonic work's listening experience in itself. This new concept will be explored in Chapter 5 as part of this planetary thinking through field recording and other sonic practices.

Another finding from this chapter shows that curating can be influenced by arts/lab collaboration, contributing to sonic-mediated exhibition lab types through intense experimentation. Here, I have also discovered how sound artists in laboratory residences experiment with field recording as a sonic practice in laboratory environments and produce sonic lab-type exhibitions. This connects with Chapters 2 and 5, which investigate field recording as a sonic planetary practice.

Applying strategies such as imaginative, utopic solutions and interdisciplinary and sensory learning, the exhibition becomes an experiment of connections and a shifting paradigm of hegemonic science. In this light, *Aerial/Sparks* is also an example of an exhibition that resulted from an artscience lab, where artists in a laboratory environment stay in residence, exchanging views with others, the curator, engineers, and scientists. According to Edwards, this type of laboratory is produced significantly through exhibitions. So, here, it is observed how laboratories work with sonic media to inspire curatorial practices.

Furthermore, this chapter's findings demonstrate that curating sound inspired by laboratories can enhance curating and show how sonic laboratories can be placed in exhibition spaces. Through the *Sounding DIY* curatorial project, I have connected curating, sound, and laboratories by exposing/exhibiting sound art and music using laboratory methods such as field recording, DIY, workshops and experimentation.

Field recording will be further explored in Chapter 5, where I will focus on field recording and listening to consider laboratories as operating within a planetary dimension. Chapter 5 will be the final chapter, drawing on Chapters 2 and 3. Field recording, as a practice, is explored through planetary thinking to examine how sonic laboratories can deploy it as a critical method.

5. Planetary Laboratory

Introduction

Chapter 5 follows the findings from Chapters 2 and 3, specifically. However, it is not a linear consequence of Chapter 4 but a side move of earlier chapters. It derives from the sonic laboratory examples I investigated in Chapter 2 (field recording) and concepts derived from analysing laboratory methods in Chapter 3 (the planetary). Building on the analysis of artists in laboratories, I propose that field recording can be understood as a laboratory practice that operates outdoors. Thus, in this chapter, I employ an analytical method, drawing on various references, to examine the notion of the "planetary laboratory" and how it can inform the possibilities of the sonic lab. This perspective involves considering the environment by including non-humans and interspecies diversity, allying with Haraway's situated practices. The planetary entails considering planet Earth as a place where human action is extended from nature to technology, and to return to nature again, seen as a processual action that gives humans the responsibility of interacting with Earth. In this chapter, I follow Ewan Chardronnet, who is a pioneer in recognising and defining this laboratory from a techno-computational perspective; Bruno Latour, who proposes the concept of the planetary as a challenge to Anthropocene; Jussi Parrikka, who recognises planetary as well as temporal and material as conditions to analyse the technological artefacts, including sonic devices; and Brandon Labelle, who states that planetary consciousness is required to acknowledge the conditions of more than human life and proposes it as a decolonial concept. Findings in this chapter include the discovery of planetary sonic laboratories, with practical examples, that produce new epistemological experiences of sound through laboratory practices.

This chapter follows findings from previous chapters. However, it is not a linear consequence of Chapter 4 but a side move of earlier chapters.

In Chapter 2, I investigated sonic artists collaborating with laboratories and using sonic methods, such as field recording, a sonic practice applied in laboratories.

In Chapter 3, I investigated different laboratory methods, enabling a critical view of the laboratory. Focusing on archiving as a method in media archaeology labs, I have found influences from deep time and the geological and planetary scale in the laboratory. This global view considers planetary and outdoor environments as part of the laboratory concept. As observed in Chapter 3, the planetary includes critical thinking of sustainable and ecological dimensions.

In Chapter 4, I researched how curating sonic laboratories can incorporate field recording, as in the exhibition *Sounding DIY* with the work of the artist BJ Nilsen.

In Chapter 5, I consider the notion of a planetary laboratory through field recording and listening practices. So, here I am focusing on the planetary scale dimension, understanding what I call the open field as part of the planetary.

I will define the open field/fieldwork/field recording in this chapter as embedded in a planetary environment. I will show how scientists started fieldwork when they opened the laboratory doors and started investigating outdoors. Kohler uses the expression ‘labscapes’. Field recording is an experimental sound art practice that includes listening practices and planetary attunement. I will follow from Brandon Labelle’s thinking, who considers "ecological listening" (Labelle, 2025, p.172), an inclusive practice for non-humans and highlights "the human as other, as one of many, and from which it becomes possible to understand oneself as a modest guest of this planetary world" (ibid.).

From there, I explore the relationship between the planetary laboratory and field recording, proposing the planetary laboratory as a term used in the arts and other disciplines. Bureau d’Études primarily uses this term to describe the "planetary laboratory" as a notion that incorporates a new vision of laboratories based on the critical view of human actions on the planet, as well as envisioning the power of nature and surroundings. Following them, I investigate field recording as a sonic laboratory practice used in planetary environments, defining a sonic planetary laboratory.

As I have shown throughout this thesis, a laboratory is both a complex place and concept. By considering sonic practices, I adopt a critical view of the laboratory; in this last chapter, I expand this critical view beyond the laboratory's walls and into the field. My suggestion is that the laboratory has to turn outside and look at the interdependency of the world, becoming planetary, ecological and sustainable. In this way, field recording can be essential to such a planetary laboratory.

In Chapter 5, I present two examples: the Field Recording Lab and the Forestscapes Listening Lab. These sonic laboratories use field recording techniques and the participation of artists such as Petr Makarov and BJ Nilsen (already mentioned in Chapter 4, *Sounding DIY* exhibition). Through this chapter, I present field recording and other sonic practices as embedded in planetary thinking.

5.1 And the Field Becomes a Laboratory

In this section, I will explore how the open field could become a laboratory. I investigate field recording as a planetary field practice. In this, I follow Bruno Latour and Steve Woolgar’s explanation of how the scaled field turned into a laboratory when scientists started to open doors and do field work outside the laboratory. This may have been motivated and enabled by portable equipment. Latour once argued that science laboratories

"actively modify the wider society by displacing crucial actors outside the laboratory into the 'field'" (Gross, 2015, p.1).

I am taking my definition of a planetary laboratory from the author Ewen Chardronnet:

> The world has been progressively transformed into a full-scale laboratory. The model of a 'laboratory world' has been added to the model of a 'factory world'. Today geo-engineering is well on the way to being commonplace, justifying, in the name of the fight against the greenhouse effect and its consequences (tropical storms, drought, etc.), experiments modifying the climate on a very large scale and transforming the chemistry of the oceans. […] The apocalyptic scenarios prophesising the end of our over-populated world justify the demiurgic experimentation of a world that has become a laboratory. The rational organisation of this laboratory-world thus becomes an irrational organisation threatening those who have created it. (Chardronnet, 2007, p.1)

Here, the planetary laboratory is described as a global consequence of human actions, and the author proposes a critical approach to these new ecological conditions on Earth. This definition connects with media archaeology theory, which refers to the planetary as concerned with environmental thinking and sustainable media. I will then present sonic practices that can critically tackle these conditions.

According to Bureau d'Études, a French collective of artists and engineers founded in 1999, "the history of the Earth is a laboratory, an experimental situation in which the animal, the vegetable, the mineral, and the human interact in a vast laboratory" (Bureau d'Études, 2008). They describe themselves as a collective of cartographers, draftsmen, architects, and artists united around the desire to promote egalitarianism and an ecological and sustainable society. Their work focuses on mapping, analysing, and critiquing the systems of power that shape our world, including capitalism, colonialism, and industrialisation. They use various media to illustrate complex ideas, including drawings, diagrams, and models. Their work has been exhibited internationally and has influenced many activists, scholars, and artists in environmental justice, social ecology, and radical cartography.

Jussi Parikka also refers to Bureau d'Études, which elaborated the term "Laboratory Planet" as the twenty and twenty-first-century science-military-entertainment-university-complex, which defines the planetary situation that installs infrastructures of power and technology. Bureau d'Études speaks of the planetary laboratory:

> Since World War, the planet is gradually transformed into a large-scale laboratory. The old model of the 'world factory' has given way to the model of the 'world laboratory.' Objects of this laboratory, can we also be the subjects? Can we reclaim

> this huge machine that became autonomous and is now developing according to its own dynamic? Can we redirect the fate and direction of this laboratory? (Parikka, 2016)

The planetary laboratory proposes a critical view towards extractivism and processes developed from colonialism. Thus, it is described as a space of interconnection between humans, nature, and technology, a space of belonging and exchanging resources and energies. It is presented here as a critique of the massive extraction of resources influenced by vitalist materialism and media archaeology theories, and by authors such as Donna Haraway. It presents roots in the actor-network theory, claiming a new space in politics toward the regeneration of practices between humans/non-humans. The planetary laboratory is aware and conscious and criticises massive development, turning Earth into a site of exploitation, agriculturally, industrially and technologically.

The planetary laboratory is then not only a place but also a concept that considers the effect of human actions on the planet. The concept of a planetary laboratory is a holistic and inclusive approach to addressing the impact of human activities on a global scale. It emphasises the need for cooperation to tackle the planet's complex challenges, promoting a more sustainable relationship between humanity and the Earth. Following Latour, human action is a decisive agent in the evolution of planet Earth. As Latour states:

> The 20th century was the golden age of the laboratory. Knowledge emerged from a confined centre of rational enlightenment, then slowly diffused out to the rest of society. The public could keep pace with the results of the laboratory sciences or remain indifferent to them, but it certainly couldn’t add to or dispute them. Moreover, the laboratory has extended its walls to the whole planet. For instance, a worldwide network of environmental sensors monitors the planet in real-time. The difference between natural history – outdoor science – and lab science has slowly eroded (Latour, 2003).

Following this perspective, Essam Heggy defines the planetary laboratory as an extensive body of technologies towards outer space as well:

> The past decades have seen progress in several areas of planetary geophysics and new sets of questions arising from ground-based, orbital, and in situ observations. Our understanding of planetary bodies will keep improving during the next decade with about a dozen missions traveling all over the Solar system and twenty more at various stages of development, whose science definition will in part rely on geophysical modelling, and, thus, laboratory data. That is increasingly changing.

> Lab work is blurring with the broader world as instrumentation becomes more ubiquitous (i.e., the world is becoming more of a lab). (Castillo-Rogez et al., 2012)

To add more definitions of the planetary laboratory, Kaji-O'Grady, Smith, and Hughes, in their book *Laboratory Lifestyles*, claim this notion of the planetary laboratory as a global condition:

> The migration of the laboratory experiment outside of its formally contained spaces, into alternate ecological systems, cities, and interstellar utopias, foregrounds an even greater expansion and augmentation of its raison d'etre. An exponentially warming planetary atmosphere renders the biosphere itself the experimental subject as scientists now contemplate its geoengineering and bioengineering. An experiment of unprecedented scale, complexity, and criticality, indeed it is the entirety of the world and the aggregate of its contentious and profligate lifestyles that now constitutes a global laboratory. (Kaji-O'Grady, Smith, Hughes, 2018, p.xxiv)

In comprehending the whole Earth through this new planetary scale and understanding all actions as a chain of reactions that influence the planet's behaviour and life's existence, the laboratory concept deserves a study and analysis from a planetary perspective. Describing the whole planet Earth as a massive laboratory where human action is extended from nature to technology, to return to nature again, is seen as a processual action that gives humans the responsibility of interacting with Earth. Consequently, in an era of emergency, humans have the power to act consciously on this planetary scale. I contend that the planetary laboratory has to be used as a voice of criticism and knowledge creation for a new era, considering the effect humans have had on Earth, possibly since the emergence of agro-logistics and through industrialism and, more recently, postcapitalism.

The expansion of the laboratory into a planetary network and its extension far beyond the confines of its conventional contained spaces embody the practice of field recording as a practice in this outside-planetary laboratory. Thus, landscapes become "labscapes" (Kohler, 2002, p.20). Field researchers use nature's particularities to develop practices of place to achieve in nature what laboratory researchers can only do with simplified experiments in contained spaces. Field recording in landscapes, planetary laboratories, and outdoor fields is a sonic practice used to investigate the possibilities of sonic laboratories.

5.2 Sonic Practices in a Planetary Laboratory

The fieldwork conducted through field recording transforms the location into a scene of the planetary laboratory, which is manipulated through experimental applications. Field recording also illustrates the relationships between humans, nature, and technology that characterise this condition of the planetary laboratory. It is crucial to recognise the

manipulation of the environment by the recordist, the technology, the staging, and the post-production to establish a critical understanding of the practice.

Many field recordists work within the landscape. On such example is Jana Winderen, who creates sound installations and compositions using recordings of underwater environments and other natural soundscapes (Winderen, n.d.); Francisco López, who uses field recordings to create ambient and experimental compositions that explore the relationship between sound and space (López, 1999-2009); and Annea Lockwood, a composer who has worked extensively with field recordings since the 1960s. Her work often explores the sounds of nature and the environment, and the cultural significance of sound (Lockwood, 2011-2022). Other artists involved in field recording are Robert Henke, Grant Smith, and Brian Eno.

When working with field recording in a landscape, the perception of the field is multiple and changeable depending on the author, and thus "the field [is understood] as an open situation" (Crone, Nightingale, Stanton, 2022, p.8) and field working becomes a "methodology" (Crone, Nightingale, Stanton, 2022, p.9). It incorporates discursive parts, including "observation and recording" (Crone, Nightingale, Stanton, 2022, p.12). Field recording as a methodology introduces more than human tools that connect with ecology. Here, it becomes inclusive when considering these factors, as "field recording is not only geography but symbolic" (Crone, Nightingale, Stanton, 2022, p.16).

Moreover, Kristen Sharp focuses on field recording as a sonic practice. Sharp states that "fieldwork as data collection is limited" (Sharp, in Crone, Nightingale, Stanton, 2022, p.51) and thus includes creative practices such as "listening" (ibid.) to understand field recording dynamically and inclusively. Sharp also introduces composition as a "creative project" (Sharp, in Crone, Nightingale, Stanton, 2022, p.58), an aspect of field recording and listening that contributes to understanding them as sonic practices with transformative power in the environments in which they are applied.

However, the notion of a planetary laboratory includes environmental critical thinking and incorporates listening, composition and field recording as sonic experimental practices. These laboratory practices "are labs of experimentation in which multiple knowledges and languages can coinhabit a given space, opening onto experiencing the dissonant coexistence of multiple ways of sensing and responding, practicing and relating" (LaBelle, 2025, pp.171-172).

According to Brandon LaBelle, field and audio recordists are attuned to the world, acknowledging the dynamics of vibrational waves echoing life through listening practices and other sonic experimental practices:

> Practices of environmental audio recording find a point of elaborated reference in the field of sound art. Bringing attention to the world around—from urban territories to natural ecosystems, along with all the entangled and enmeshed junctures between—a great deal of sound artworks are driven by a fascination with existing environments, as well as in creating environments in which sound can be experienced through diverse manifestations. These are works that find in sound a vital materiality, a matter constitutive of and constituted by living worlds, and that further aspire to narratives of creation: that seek to sound out emergent worlds, giving animation to what is there and also what might be. Following upon the creative force of sound, works of sound art often harness, amplify, and rhythm into being a living system, one that seeds and grows experiential situations of listening grounded in relations to place. These include the recording of a vast range of sites, as well as other ways of collecting and presenting sound. Such modes of work echo Snyder's practice of the wild, in terms of finding ways of attuning to the "living mind" of a planetary consciousness, where one's sense of self is felt as environmentally shaped, as touched by and participant within a greater weave of natural intelligence. By way of such an expanded perspective, sound is posited as a vitalist force that lends to an ecological position; from the vibrational to the resonant, the rhythmic to the echoic, sound opens onto ways of honoring existing ecologies as well as generating new paths of connection (LaBelle, 2025, p.174).

On the one hand, the planetary laboratory is a place of transformation, where extractivism, resource exploitation for industrial-technological processes, such as mining, occurs. On the other hand, the critical approach to this planetary laboratory brings a connection to nature, world attunement, and planetary listening, which entails "Ecological thinking, [and] figures a worldview that honors the animistic, sentient qualities of the earth, and that works at decolonizing the legacies of settler-colonialism, and related knowledge regimes, which position nature as a resource." (LaBelle, 2025, p.180).

Labelle considers planetary thinking to be decolonial, which is very important for the findings of this research. Hegemonic science in laboratories has been shown in this research to be a detrimental factor in knowledge production (imposing views and excluding others). As seen in feminist labs (Chapter 1), decolonising mainstream science and laboratories that are part of technoscience's contextual and social dynamics will enable transparency and hybrid and inclusive practices. Moreover, sonic practices such as field recording and listening also opt for reconfiguring an anticolonial position. Feminist, decolonial or anticolonial options align with situated knowledge and vitalist materialism theories.

In *The Sonic Ecologies of Anticolonial Writing*, by Hypatia Vourloumis, the artist presents sonic practices that apply anticolonial theory, such as poetry writing:

> Approaching examples of anticolonial poetry as 'material formations' and performances of affect through a Spinozist lens that understands that all bodies and things have the capacity for activity and responsiveness, I deeply listen to, and acknowledge, how the writing of sound is an exercise inseparable from the listening and writing body's placement, within a sonorous environment (Vourloumis, 2021).

This planetary thinking, incorporating the understanding of life matter, allows my research to connect to the laboratory outdoors through a sonic approach. I research sonic practices, such as field recording, composition, listening, and poetry, but I mostly approach the sonic laboratory critically, meaning I focus on field recording as a sonic practice that engages with the planetary laboratory when doing fieldwork, allowing listening and promoting composition. Next, I look at some pertinent examples.

Mark Peter Wright's work aligns with media archaeology theory and connects to planetary thinking, field recording, and laboratory practices; Wright writes, "The planet has been terraformed by humans and their technologies to an extent that we have entered a new geological epoch" (Wright, 2022, p.45). The author refers to "sonic extraction" (Wright, 2022, p.44) as belonging to the sonic field work done through technological apparatus such as field recorders. Fieldwork entails the understanding of planetary attunement, incorporating vibrant life to be captured but acknowledging limitations: "what Jonathan Sterne has called the "preservation paradox:' the contradictory promise of conservation versus the inevitable frailty of media" (Wright, 2022, p.46). Wright aims to push "sonic responsibility, both moral and aesthetic, into everyday consciousness" (Wright, 2022, p.47).

Field recording limitations in planetary listening (the impossibility of capturing non-human frequencies and other living elements) can be mitigated by highlighting technological-material aspects of the apparatus. A critical awareness of these limitations may show hegemonic impositions of culturally extracted sounds with highly technological apparatus created in laboratory-mediated environments. The sound apparatus's material footprint and technological development connect with media archaeology theory's methods. It works like reverse engineering, which attempts to materially decompose the technological apparatus and decipher our civilisation's socio-cultural component.

Following *Eco-Sonic Media* (2015) by Jacob Smith, field recording as a sound practice can be included in investigating the ecological impacts of various music recordings and production forms. Smith proposes implementing a 'green-media archaeology' to uncover forgotten or disused forms of sonic media technologies, which could provide clues to more

sustainable alternatives for the future. *Eco-Sonic Media* refers to the use of sound in environmental communication or media, an emerging field exploring how sound can be utilised to communicate environmental issues and raise awareness about environmental challenges. It could also refer to the use of sound in ecological research and monitoring. This aspect of dealing with environmental matters gives eco-sonic media a planetary dimension. The ecological impacts of media culture often go unnoticed, including the energy consumption required to power massive server farms, the mountains of electronic waste filling landfills, and the extraction of rare minerals needed for electronic devices. This point connects with media archaeology theory, which influences laboratory practices such as sonic laboratories, archiving and curating, that defies imposed objectual archival culture of power-knowledge through criticising the institutional process of rationalist objectivity and linearity, proposing notions of deep time and media materiality.

Most field recordists use portable recording technologies, and most recordings are repurposed and used in compositions and live performances. Considering the field through a planetary scale and field recording as a sonic laboratory practice that uses recording technologies and listening practices allows me to incorporate the laboratory concept through media archaeology theory and to overview the possibilities of field recording as a laboratory practice. Field recordists enable sonic practices such as field recording in a planetary laboratory through outdoor landscapes and natural environments. The notion of the planetary laboratory allows me to rethink nature outdoors, not simply as nature or landscape. Still, it is a condition resulting from collective and global changes linked to human material and technological extension, and that is also a place for the cohabitation of the species.

5.3 Planetary Sonic Laboratories

To end this section on sonic practices in the planet laboratory, I present two examples of sonic laboratories that use field recording/listening in the labscapes. Artists, creators, curators, and other agents collaborate in researching sonic practices that enable a critical view of the planetary laboratory.

The first example is the Field Recording Lab. It is the name of a series of sound research made in the High North, Kirkenes, Norway. It is focused on the sounds of nature and their effect on humans. The laboratory has been regularly held since 2018 in collaboration with experienced theorists and sound artists. Field Recording Lab 2023 is a five-day test lab in partnership with Barents Spektakel. It is developing synesthetic research of the light environment of Kirkenes, a border town beyond the Arctic Circle, where urban lighting systems were formed according to the specifics of the polar night. The participants of the laboratory study the nature of electric light and become co-authors of light-sound walk routes and performers of a cartographic piece made individually or in collaboration.

Technogenic light streams are created according to the inertia of human vision and carry a large amount of “hidden sounds” — information that is invisible to the eye but within the temporal limits of our auditory perception (Field Recording Lab, n.d.).

Laboratory participants can listen to the city's light landscapes and create a light and sound map of the area. These lightscapes are combined from various electric light sources, such as advertising constructions, car headlights, and street lighting. As part of the laboratory, participants will become co-authors of light-sound walk routes and performers of a cartographic piece. They will be invited to participate in a joint sound performance as part of the public program at the Barents Spektakel festival.

The results of the light-sound walk will be presented as a multichannel sound installation, the light portrait of the area preserved in sound. This will allow the audience to hear directly how the urban environment changes under the onslaught of new technologies.

In 2022, the laboratory participants studied the nature of electric light and became the performers of a cartographic play from the Lighthub cycle. With the help of special converters, they could synesthetically study the city's light environment and transform the usual sources of urban lighting into a single, multi-channel sound work. The final work was presented at the Inversia festival at the Murmansk Regional Scientific Library.

In 2021, the principal locations were two industrial monotowns, Apatity and Kirovsk, situated at the bottom of the monumental mountain chain of the Kola Peninsula—the Khibiny Mountains. The project would take place at a unique time when daylight was extended and the sun was on the horizon for 24 hours.

The Field Recording Lab is the final stage of the international research project Murmansk Prospekt, in which artists from Russia and the Netherlands explore the Northern Soviet heritage and the features of Arctic urban territories.

The second example is led by a collective of researchers and artists presenting the Forestscapes Listening Lab project. The team is formed by Maud Borie, King's College London; Liliana Bounegru, King's College London; Angela YT Chan, artist; Jonathan Gray, King's College London; and Andrés Saenz de Sicilia, sound artist at Northeastern University London. The collective has participated in exhibitions, workshops and hackathons at re:publica 23, the digital society festival in Berlin; Seeking Connection at the Bush House Arcade in London; EASST-4S 2024 in Amsterdam; and at Science Gallery London, as part of Pulse of the Planet.

The listening lab is part of the Forestscapes project, which examines how soundscaping can show different ways of knowing, imagining and experiencing forests. As part of this project,

the collective is developing generative arts-based methods for recomposing collections of sound materials to support “collective inquiry” into forests as living cultural landscapes. The event includes music, film, spellcasting, tarot, and more. In their words:

> While many previous works have explored sound as a medium for sensory immersion (e.g. field recordings), forestscapes explores how recomposing sound material may explore forests as mediatised and contested cultural landscapes: diverse sites of many different (and marginalised) kinds of beings, relations, histories and representations. As part of the project, we will co-create new sound works, as well as generative composition techniques using open-source software and hardware (Public Data Lab, 2025).

Fig 10. Forestscapes Listening Lab. Copyright Public Data Lab

This description includes working with open-source software and hardware (for example, Supercollider), a feature in many laboratory methods (such as DIY, workshops, and hackathons analysed in Chapter 3), used by alternative laboratories such as hacklabs and feminist labs.

Moreover, this sonic laboratory applies listening as a sonic practice developed in laboratory environments. The collective group states, "In contrast to listening as individual immersion in curated recreations of nature – the lab will explore listening as a collective practice of unsettling and reconsidering nature-culture relations and how ecologies are mediatised, commodified, laundered and contested" (ibid.).

Moreover, the project addresses "the effects of climate change; habitats for endangered species; hotspots of biodiversity; part of poverty alleviation programmes; sites for ecotourism, health and wellbeing; scenes of neocolonial afforestation; backdrops for corporate greenwashing; landscapes of danger, violence, destruction and resource conflicts" (ibid.) The comments connect with this research in positioning sonic labs in a planetary dimension, which critically approaches nature, landscapes and human activity on earth. They aim to work with "different kinds of planetary futures [that] may emerge" (ibid.). In this sense, sonic planetary labs may behave ethically towards the surroundings, but also consider the needs of future generations.

Different components of the listening lab are interesting for this thesis, such as the planetary approach through sonic practices applied as a laboratory. Moreover, the critical component of these planetary sonic laboratories proposes a new perspective on the environment and the landscape. Most importantly, these practices reposition the critical dimension of field recording/listening and embed it into a sonic laboratory.

Listen here: https://soundcloud.com/culturalkings/forestscapes/s-jjuJfHHsQ5u

The compilation presents different examples of field recording around the world, from the savannah in Botswana to field recordings from research on forest fire management. There are also examples of conservation politics in Cambodia, and field recordings from research on forest governance. The recordings also represent themes such as research on ecological restoration, anti-deforestation activism. The artists are Anna Smith, Kapil Yadav, Samantha Day, Desiree Foerster, Angela YT Chan, and Desiree Foerster, among others.

Conclusion

For future research as a curator, I plan to develop a curated sound artist residency in a laboratory type, using planetary listening mediated by sonic practices, which will take the form of mostly soundwalks and field recordings.

As explored in this chapter, fieldwork is used to investigate the sonic properties of a particular outdoor environment. Field recording also provides opportunities for experimentation and improvisation as a creative practice in exhibitions, artist-in-residence programmes and events. However, it needs to be addressed critically as it belongs culturally and technically to colonial/extractive industrial-capitalist tendencies. One conclusion of this chapter is that field recordings embodied in the natural landscape can raise awareness about environmental issues and encourage people to listen more carefully.

This chapter clarifies how the notion of the planetary laboratory contains the critical understanding of a produced and connected technological world while proposing a view of inter-species interconnected with life on Earth. Through sonic practices, from field recording to listening practices, the vibrant essence of life can be consciously mediated and understood. The planetary, following LaBelle, promotes a critical approach when colonial practices only treat nature as a resource. LaBelle engages with the decolonial or anticolonial discourse, understanding the environment as a more-than-human-alive element.

Furthermore, Chapter 5's findings identify sonic practices that can tackle the planetary and become a planetary sonic laboratory. These examples, for instance, the Field Recording Lab, enhance a laboratory that is aligned with media archaeology theory (Parikka), eco-sonic media theory (Smith), and decolonial and anticolonial theories (LaBelle).

Through sonic practices, the planetary sonic lab envisions the Earth as an experimental situation where humans, nature, and technology interact. This potential sonic lab is a critical framework for addressing extractivism and colonial legacies. Acknowledging the interconnectedness of humans, non-humans, and the environment, the planetary sonic lab offers a space for reimagining practices and politics following Latour.

Having studied the different incidences and possibilities of the use of sound in a planetary sense, such as the Forestscapes Listening Lab, the combination of the sonic laboratory and the planet laboratory presents opportunities for critical engagement with a potential planetary sonic lab as a site of knowledge production that can address contemporary issues. The examples of this chapter demonstrate that by incorporating diverse sonic practices and perspectives, this laboratory can explore hybrid creative and sonic practices within the planetary context.

In this chapter, Chapter 5, I employ an analytical method, drawing on various references, to examine the notion of the "planetary laboratory" and how it can inform the possibilities of the sonic lab. This perspective involves considering the environment by including non-humans (or more than humans) and interspecies diversity, allying with Haraway's situated practices. The planetary entails considering planet Earth as a place where human action is extended from nature to technology, and to return to nature again, seen as a processual action that gives humans the responsibility of interacting with Earth. The planetary is also considered a decolonial or anti-colonial process in sonic art practices, such as listening and field recording. Findings in this chapter include the discovery of planetary sonic laboratories, with practical examples, that produce new epistemological experiences of sound through laboratory practices. This leads to the Conclusion of the thesis, where I will resolve my research question and contextualise the findings of previous chapters.

Thesis Conclusion

In the Conclusion, I present the novelty about the sonic laboratory, and answer my research question, about the possibilities that entail working/creating in a sonic lab environment, following the findings and suggestions from the thesis: a feminist approach, a decolonial/anti-colonial perspective, a planetary scale and a situated and hybrid practice.

Throughout the thesis, I have found evidence of the existence of sonic laboratories. For example, the historical antecedents of Bell Labs and the Thomas Edison Laboratory represent an inspiration and a model for future sonic labs. However, I have recognised that some of these models can become hegemonic; thus, I distance myself from them in addressing my research question. I have encountered examples such as MusicMakers Hacklab and Music Hackspace London that represent a hybrid model of sonic labs that integrate with hack labs. Although existing, the sonic lab can renew patterns, features, and behaviours. Thus, the sonic lab is not a new category but rather a re-description of existing infrastructures. It is, however, a critical proposal that challenges the imbalances in laboratories that perpetuate inequalities and hegemonies. Moreover, what is new in relation to existing lab discourse is the adoption of hybrid, situated, planetary and feminist approaches. Originally, laboratories have presented imbalances and inequalities; addressing these imbalances and inequalities constitutes a redefinition of the laboratory. Diversity and plurality became permanent structures in lab behaviour from the 90's and so on. With the renovation of the medialab, including spaces such as hacklabs, biolabs, fablabs, makerspaces, and the sonic lab, it is important to ensure inclusion of other genders. For example, the Thomas Edison Laboratory is an all-male laboratory, whereas feminist labs include women artists and attend to non-human/more-than-human agencies. Moreover, trans and queer representation became integral to feminist labs. Moreover, inequalities along racial and political-class lines are also considered when establishing media archaeology labs. Additionally, situatedness is a new condition to evaluate in laboratory behaviour, informed by Haraway's theories and the intention to reformulate practices through communication with surrounding environments, making them more flexible, more context-dependent, and more responsive to nearby agents. Traditional laboratories, in a sense, behave more hegemonically, excluding and imposing patterns, whereas situated laboratories become hybrid entities.

From here, I can state that the criteria why a lab becomes sonic, firstly, is being a sound-centric lab that operates through research, curating, and using critical thinking, as well as, secondly, participating in methods such as field recording, prototyping, diy, workshops, or archiving, among others. As the thesis shows, labs are complex entities, variable depending on their agents and spaces that broaden their practices. Thus, the sonic lab definition won't

be unique and will instead become multiple and complex. One criterion for determining when a lab becomes sonic is that its outcomes are sonic-centric across different methods and approaches. A sonic lab can engage in field recording or prototyping, but the outcome will always be a composition, sound installation, or other form of sonic expression. In the case of sonic devices, these serve as philosophical tools or techno-cultural apparatuses developed in sonic labs that adopt the hacklab model. They employ radical practices that could contribute to critiquing the dominant models of techno-capitalist society through the development and consumption of gadgets. Sonic devices developed in sonic labs through prototyping can be seen as revolutionary mediated technologies that propose transparency, openness, and situated practices; these can serve as a criterion for understanding the sonic lab. Moreover, the sonic lab can employ various approaches to sound, including aesthetic considerations for ensembles and the curating of online or physical spaces. In the context of curating sonic labs, the intersection of these three concepts constitutes a classificatory condition for developing sonic labs that challenge the traditional white-cube museology. The sonic lab can also serve as a critical laboratory for examining technology behaviour. Additionally, the sonic lab can become an interdisciplinary space for exploring the sensory aspects of sound. The sonic lab is enriched by methodologies proper to other labs, such as media archaeology labs' archiving practices. But it also has its own methodologies, such as field recording, that enhance an outdoor practice becoming planetary, and so decolonial, thereby promoting new sonic epistemological experiences.

The findings of this thesis demonstrate that certain laboratories are expanded by sonic practices and that, in turn, certain sonic practices find new application in laboratories. This thesis aimed to demonstrate how laboratories can help rethink the concept of a laboratory environment, thereby establishing a platform that encompasses the potential of the sonic laboratory. This serves as an umbrella, keeping a wide range of possibilities for the sonic laboratory, where innovative and subversive artistic expressions can be created, as exemplified in John Cage´s work Variations VII (Chapter 4). The laboratory becomes a space where experimentation and exploration challenge established norms, proposing alternative narratives and opposing hegemonic paradigms.

Throughout this research, I critically examined various laboratory typologies and their methods, which contribute to identifying hybrid labs, i.e. labs where behaviour is clearly reframed as inclusive according to feminist principles, and also acknowledging laboratories as complex and multiple spaces, as seen in Chapter 1's definition of hybrid labs by Wershler, Emerson, and Parikka. In Chapter 1, when discussing Science Labs, I found that these types of laboratories can also be called counter-laboratories, following Bruno Latour's definition of "counter-laboratories" (Latour, 1987, p.79), which defies conventional, industry, and

finance-based laboratory practices. Moreover, in Chapter 1, as examples of counter-laboratories, this thesis has found that hackerspaces and hacklabs are places where not only scientists operate and work but also artists, hackers, and coders, among others. Another finding suggests that counter-laboratories utilise "counter-methods" (Livio and Emerson, in Bogers and Chiappini, 2019, p.291) as found in Chapter 1, Feminist Labs.

By embracing sonic and laboratory practices and adopting decolonial, anticolonial, materialist, feminist, and planetary perspectives, laboratories can become transformative spaces contributing to knowledge creation and producing inclusive practices in various fields. The final observations of this research point to a type of planetary sonic laboratory that brings together different issues:

- The planetary, which allows turning laboratories into a more-than-human concern and focuses on the outside, too. This opens up potential for labs to become more inclusive.
- The sonic, which gives laboratories an artistic frame and positions labs to become interdisciplinary.

Next, I list the findings of this thesis under key terms. I have chosen to do it this way because it effectively summarises the main points discussed and found through the research. It enables me to outline a list of clear points and demonstrate my approach to summarising the potential of sonic labs.

Findings of this Thesis:

Hybrid lab:

Through the thesis, I have observed that the definition of the laboratory is wide, multiple and diverse, as laboratories offer different possibilities (see, for example, in Chapter 1, Bofill). Even at the end of my investigation, the laboratory concept remains open and complex, as per its variety of spaces and locations (academic labs, science labs, industrial labs, medialabs, hacklabs, feminists' labs, artscience labs, etc.), as well as practices and contributions. In fact, the laboratory definition becomes wide open because of the activities they promote (knowledge production through research and development, ideation of prototypes, creation of artworks, and exhibitions, among many more).

Following Lori Emerson in Chapter 1, I have understood that in feminist studies and Henri Lefebvre's Marxist Theory, laboratories are open, malleable, and determined by the practices, contexts, and people that develop them.

Laboratories are multiple, hybrid, malleable, and subject to changes. Darren Wershler, Lori Emerson, and Jussi Parikka coined the term hybrid lab, which refers to an idea inspired by

Bruno Latour's argument that explores the emergence of novel hybrid actors: researchers and scientists collaborate in a hybrid lab to address complex issues requiring interdisciplinary approaches. Through the thesis, I found that sonic laboratories are hybrid, alternative and counter-hegemonic. For example, Joasia Krysa's exhibition *Erkki Kurenniemi (In 2048)* at Documenta 13 (2012) is a curatorial hybrid between new media curating and sound art to display computer techniques, archival material, and original prototypes of Kurenniemi's handmade instruments. In this way, I can state that exhibitions can function like laboratories, and when exhibiting sound art, they become sonic laboratories.

I have also found further evidence that laboratories are hybrid. In Chapter 2, I refer to Robertina Šebjanič and her practice in sound, art, science, and technology, and how new media works resulting from the interference between these fields create hybrid media, i.e. a media that, in the case of Šebjanič, uses methods such as field recording and developing narratives, which intrinsically belong to sound and sound art. Both methods enhance media practices in laboratories that become alternatives to mainstream, institutionalised and hegemonic laboratories. In this sense, sonic laboratories, too, can be considered hybrid entities once hybrid sonic media are produced, as seen in Šebjanič's example.

Decolonial:

In my survey of different laboratories, I have also found that adopting decolonial practices promotes inclusivity, integration of otherness, and collaboration with non-Western artists. An example is the Agbogbloshie Makerspace Platform (as seen in Chapter 3) – a laboratory that operates outside the visibility of Western-centred laboratories. Furthermore, I have found examples of media labs situated outside Western and Eurocentric positions in Asia, America, and Africa. These labs operate critically, opposing Western labs, and they apply and work with sonic media. One example is Astrovandalistas (presented in Chapter 1 by Tania Aedo), “a decentralised laboratory in different locations in Latin America, such as Mexico and Brazil (…), developing low-tech tools that enable new forms of communication and collective participation with open software and open hardware that can be easily replicated” (Aedo, in Bradbury and O’Hara, 2020, p.200).

Moreover, through this thesis, I have found that non-Western laboratories are examples of places applying sonic practices. For example, in Chapter 1, Medialab, Hacklab, and Other Typologies, and following Tania Aedo. She presents examples of sonic practices developed in these alternative laboratory environments, such as Astrovandalistas, “a decentralised laboratory in different locations in Latin America, such as Mexico and Brazil” (Aedo, in Bradbury and O’Hara, 2020, p. 200). Another example is MusicMakers Hacklab, in Mexico City and Tijuana. Both examples contribute to the ideation of a non-Western laboratory that

focuses on sonic practices, mainly with open-source. Thus, non-Western contexts facilitate the discourse to displace hegemony from a central, powerful position. Decentralising incorporates situated knowledge through inclusive, respectful, local, and critical practices defended by feminist labs and others.

To end, decolonial or anticolonial are key terms to define a planetary laboratory (see Chapter 5, LaBelle). The author opposes practices of colonial hegemonic science that "position nature as a resource" (LaBelle, 2025, p.180) to those decolonial and sentient, respectful to alive matter and non-humans. This attunement to the world also involves planetary listening, which contributes to developing the potential factors of a critical sonic lab.

Planetary:

Through studying media archaeology laboratories, I have identified that these laboratories operate on a planetary scale, meaning they are conscious of the human effects on the planet Earth and that they have a global idea of the effects and practices they promote. As shown in Chapter 3, Archiving, planetary entails a more-than-human philosophy that operates inclusively and challenges standardised views of creation. Planetary is connected to geological processes, as well as the time dimension. There is a "'time criticality' of each device" (Emerson, n.d.), and this criticality connects to planetary. Thus, I have found that a critical planetary consciousness can enable a critical view of the laboratory model. Moreover, through planetary-scale knowledge, I can approach the outdoor field as part of a planetary environment to study sonic practices such as field recording and listening.

Another finding of the thesis indicates that archiving as a method proposes a material and planetary approach to knowledge production in media archaeology laboratories, incorporating techniques such as hardware hacking and circuit bending, for example, Erkki Kurenniemi's laboratory. There are examples of media archaeology labs that promote sonic exhibitions, such as the Erkki Kurenniemi exhibition, which re-enacts Kurenniemi's sonic archive (as demonstrated in Chapters 1 and 3). I have found that these laboratory types reinforce a critical approach to traditional archives and opt instead for situated knowledge theories as articulated by Haraway's concept of "co-operation" (Haraway, 1991, p.93), in a context where subjective knowledge considers the feminist social approach of collaboration mediated through situated practices against imposition models.

Moreover, all of Chapter 5 is dedicated to planetary and I have argued how this concept entails two positions:

- A negative view of the global human actions towards Earth.
- But also, a critical view of these negative actions that incorporate consciousness.

I have found that the planetary mediated by sonic methods/practices such as field recording and listening enhances a critical approach, radical experimentation and an awareness about environmental issues.

For example, there is evidence of the existence of sonic labs that become planetary sonic labs, such as Forestscapes Listening Lab, which presents opportunities for critical engagement as a site of knowledge production that can address contemporary issues.

Feminism:

Through studying Feminist Labs and feminist hackers' views, I have also encountered a definition of the collaboration between technology and science, which, according to them, remains rooted in patriarchal, colonial, and hegemonic powers.

Moreover, through this research, I have applied Haraway's explanation of situated knowledge to define hybrid and sonic laboratories. Mostly based in feminist studies about laboratories, in Chapter 1, I have discovered that non-hegemonic laboratories (for example, feminist labs, hacklabs, sonic labs, etc.) should embrace a situated and specific position, acknowledging the diversity of experiences and perspectives of individuals, particularly women, rather than attempting to establish a single universal view and knowledge. Haraway, through a feminist/new materialist approach, defines the model of scientific truth as a result of developed capitalist countries into the imposition of technoscientific structures (of which laboratories are part) that have condemned the whole earth, including non-developed countries, to extinction and scarcity, perpetuating politics belonging to capitalism, colonialism, and patriarchy. Haraway proposes a practice of "partiality and not universality" (Haraway, in Emerson and Livio, 2019, p.291), which has also been developed in feminist labs (as explained in Chapter 1). In addition, I have also found that feminist labs originate from the exclusion of male-dominated laboratories, hacklabs, and medialabs, where females have been marginalised. I have observed that a feminist lab model that includes women and explores other possibilities through inclusivity, posthumanism (considering non-human otherness), and accessibility will positively influence the sonic laboratory.

Continuing to examine feminism in Chapter 1, I have found that female hackers' view of science has contributed to creating a critique of the hegemony created through colonialism. Labs are inseparable from the origins of science, as "science is a project with colonial origins" (Livio and Emerson, 2019, p.290). Moreover, through this thesis, I encountered evidence that feminists such as Freeman propose this hegemony as part of a "'tyranny of structurelessness'" (Freeman, in Toupin, 2014, p.12), and tyranny is a concept that belongs to oppression, control, and practices that legitimate an imposition. This suggestion inspires

sonic labs models to behave according to Feminist Labs and oppose the tyranny of hegemonic practices.

Curating:

In chapter 4, I have observed that curating can become an experimental practice through collaboration and art and science exchange. I have worked through the example of the Experiments in Art and Technology (E.A.T.), and specifically John Cage's work *Variations VII,* produced in the context of E.A.T., to demonstrate that there is potential to curate sonic-mediated events unconventionally, facilitating experiences and knowledge in curating laboratories.

The thesis also finds that curating sound art can distance us from institutional visual culture and promote sound-mediated exhibitions. One is *Aerial/Sparks*, an initiative that enables artists such as Robertina Šebjanič to challenge purely scientific laboratories.

The Sonic Laboratory:

Through the thesis, I have encountered that critical thinking can contribute to creating and reformulating alternative laboratories based on feminist, materialist, decolonial, and planetary approaches. Following the investigation of these approaches, I conclude that the sonic laboratory can challenge traditional power structures embedded in institutions and foster a more inclusive and dynamic approach to knowledge creation. I have found that the application of sonic practices, such as field recording and listening, as observed in Chapter 5, contributes to embedding these sonic labs in planetary thinking, which entails global and inclusive development of practices. The laboratory is also where we shape the world from nature, reconfiguring objects and producing beneficial social results, as seen in Chapter 1, the laboratory definition, according to Latour, and also in Chapter 4, with curatorial experiments with activists and laboratories by Billy Kluver. Hence, experimenting with sonic practices and technologies in sonic laboratories, as seen in Chapters 2 and 3, can produce results that are attuned to the environment, criticising societal processes and creating a conscious awareness of human activity in the world/society.

I recognise the laboratory as a complex place dedicated to science that may become hybrid and diverse thanks to fusing with the arts and other methods. I understand how sound practices exemplify interdisciplinarity between sound and science, developing alternative sonic practices in laboratory environments.

Throughout this research, I have been searching for a sonic laboratory identity and have found that some examples of sonic labs offer a critical approach to technology; I have shown that this is the case of the Sonic Immersive Media Lab at Goldsmiths (SIML), in Chapter 2.

This lab positions the sonic as a critical space that is open and alternative to institutional/hegemonic labs that develop only through science. Sonic laboratories have become places of experimentation, and their characteristics include creating sound works, among others. Mainly, sonic laboratories produce sound works through process, research, observation, narratives, field recording, listening, hardware/software, and prototyping (see Chapter 2). The outcomes of these sonic laboratories are varied and rich, including sound works, musical compositions, sound installations, and exhibitions.

Discussing the examples of artists in science labs, for example, Robertina Šebjanič, I have also found that sonic laboratories are interdisciplinary spaces where experimentation and creation contribute to exhibitions. Moreover, sonic laboratories incorporate aesthetic principles by curating sound works, as is the case with Sonic Lab UVic (University of Victoria).

The thesis findings indicate that academic sonic laboratories are spaces dedicated to sound studies, such as the Laboratorios Sonoros (Musica UNAM, Mexico), which focuses on research and sound art development. Knowledge production is facilitated thanks to the collaboration of science and the humanities. Academic sonic labs are also hybrid models of laboratories and are broad-based through different practices: research and development, curating, and sound technology development.

In addition, I discovered that in sonic laboratories, through sound art practices and artists, sound becomes a practice that destabilises hegemony through creativity. Sound artists in laboratory residences apply sonic methods and produce artistic outcomes that contribute to knowledge production by adopting, for example, in Robertina Šebjanič's practice, narratives and vocals, and humanities components that include humans and non-humans.

Finally, through the thesis, I have identified a new type of laboratory that uses field recording/listening. By investigating the field as part of planetary processes and understanding the laboratory as an extension into outdoor spaces, the "planetary sonic laboratories" propose a critical approach to global processes rooted in the colonial legacy of hegemony and extractivism. Moreover, I find examples of sonic labs that operate counter-hegemonically. For example, these field labs incorporate destabilising, displacing categories, and presenting other perspectives in creation, creativity, and knowledge production as demonstrated in Chapter 5 and following *Eco-Sonic Media* (2015) by Jacob Smith, field recording as a sound practice connects with media archaeology which defies imposed objectual archival culture of power-knowledge, through criticising the institutional processes of rationalist objectivity and linearity proposing notions of deep time and media materiality.

In discussing field recording labs in Chapter 5, I have also encountered planetary sonic laboratories understood as a decolonial practice (LaBelle, in Chapter 5). This aligns with the spirit of feminist labs' and feminist hackers' practice of producing situated knowledge instead of developing colonial laboratories.

Future outcomes: ***curating sound artists in laboratory residences.***

Inspired by the ideas/processes of planetary sonic laboratories, I plan to develop future research as a curator in sound artists' residences in laboratory-type environments, utilising planetary listening and other sonic practices.

In the context of this aim, I understand that the sound artists' residency would be an independent, experimental space, owned by a team of curators and artists that I direct. By creating practices based on the embodiment of nature and technology, the lab aims to transfer the contemporary needs of technological society to ancestral nature and paradisaic environments. The residence promotes the ecological use of technology and seeks to recover rural heritage.

There will be work with different disciplines, focusing on sound: digital, composition, music, sound art, sonic practices, electro-acoustic, acoustic ecology, acoustic, live coding, field recording, listening, soundwalks, and radio.

The curatorial aim is about re-framing nature and technology: Facing the contemporary environmental crisis, this project is born from the need to rethink nature and re-conceptualise technology as an open-source tool for communities. Through the residency, I aim to promote how to re-conceptualise nature and approach it dynamically through cultural activism and critical thinking.

Influenced by a media archaeology approach and re-framing technology through open-source and community practices, the sound arts residency proposes technology as a creative practice. Thinking about technology critically allows a critical approach to landscapes, nature, and technology. The residency will use open-source hardware and software and work with a DIY ethos in workshops. It will produce sonic-centred works encompassing planetary concepts in dealing with the environment and their approach through technology.

The sound artists' residency aims to approach the concepts of nature and technology critically and offer a contemporary version of environmental thinking and the climate crisis.

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