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Participatory practices in urbanism as a tool for the analysis of pollution : the perception of pollution in Grenoble, France

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Afroditi Avgerou. Participatory practices in urbanism as a tool for the analysis of pollution : the perception of pollution in Grenoble, France. Architecture, space management. 2023. <dumas-04216502>

HAL Id: dumas-04216502

<https://dumas.ccsd.cnrs.fr/dumas-04216502v1>

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Master Urbanisme et aménagement Parcours Transformative Urban Studies
2022-2023

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Participatory practices in urbanism as a tool for the analysis of pollution

The perception of pollution in Grenoble, France



Notice bibliographique

Projet de Fin d'Etudes Master Transformative Urban Studies

Auteur/Autrice : AVGEROU Afroditi

Titre du Projet de Fin d'Etudes : Participatory practices in urbanism as a tool for the analysis of pollution - The perception of pollution in Grenoble, France

Date de soutenance : 07/09/2023

Organisme d'affiliation : Institut d'Urbanisme et de géographie alpine

Organisme dans lequel le stage a été effectué : Wageningen University and Research

Directeur/directrice du Projet de Fin d'Etudes : Duché Sarah

Collation : Nombre de pages : 67 / Nombre de références bibliographiques : 71

Mots-clés analytiques : Pollution, Urbanisme participatif, Alternative cartography, Sensorial mapping

Mots-clés géographiques : Grenoble

Abstract

This master thesis examines the role of participatory research and practice in urbanism and how participation can be an effective tool to better understand, analyze and possibly decrease pollution in urban areas. In our days, urban areas face many environmental issues related to pollution that lead to further social and spatial inequalities. As the majority of the human population is living in cities, the active engagement of people can be the key for a change towards less polluted urban environments. Through the participation of inhabitants from different neighborhoods of Grenoble and the implementation of alternative cartography methods for data collection, this master thesis aims to study and analyse the way people perceive various types of pollution and how this affects the way they use urban public space. The findings of the data collection highlight a common perception of various types of pollution and a collective experience of the urban space in relation to pollution. Through an analysis of the notion of urban commons, it is argued that this collective perception of pollution in cities, can be considered a new urban common.

Resume

Ce mémoire d'études examine le rôle des pratiques participatives en urbanisme et en recherche, et comment la participation peut être un outil efficace pour mieux comprendre, analyser et éventuellement réduire la pollution dans les zones urbaines. Aujourd'hui, les villes sont confrontées à de nombreux problèmes environnementaux liés à la pollution, conduisant à davantage d'inégalités sociales et spatiales. La majorité de la population humaine vit dans les villes et l'engagement actif des personnes peut être la clé d'un changement vers des environnements urbains moins pollués. À travers la participation d'habitants de différents quartiers de Grenoble et la mise en oeuvre de méthodes alternatives de cartographie pour la collecte de données, ce mémoire vise à étudier et analyser la façon dont les gens perçoivent différents types de pollution et comment cela affecte leur façon d'utiliser l'espace public urbain. Les résultats de la collecte de données mettent en évidence une perception commune des différents types de pollution et une expérience collective de l'espace urbain par rapport à la pollution. À travers une analyse de la notion de "urban common", il est avancé que cette perception collective de la pollution dans les villes peut être considérée comme un nouveau "urban common".

Acknowledgements

I would like to thank my academic advisor, Sarah Duché, for her invaluable guidance and support throughout the research and writing of my master thesis. I would like to express my sincere gratitude to Mariana Rios Sandoval and Anita Hardon for giving me the opportunity to conduct my internship at Wageningen University and Research, and for all of the resources and support they provided. I would also like to thank Philippe Rekacewicz for his support in the research process. Finally, I would like to thank all of the participants in my study for their time and willingness to share their experiences. This work would not have been possible without their contribution.

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Introduction

In the contemporary world, the majority of the human population is living in urban areas. Cities can be characterized as the “habitat of the humankind” while rural areas are becoming gradually less populated (Kirabo Kacyira, 2012). There are various factors that historically led to the growth of cities and to the urban sprawl of contemporary urban areas such as the economic growth which attracts new citizens (UN-Habitat, 2018). In our days, urbanization is one of the most common phenomena in most countries around the world and has many effects on society and on the natural environment. Increasing urbanization is linked to the climate crisis due to its connection with pollution, natural degradation, CO₂ emissions, deforestation and other human activities that negatively affect the environment (UN-Habitat, 2018). As more and more people move to cities globally, human activity increases. This activity consists of new constructions, transportation, vehicular movement all of which lead to various types of pollution (Steffen et al., 2015).

The climate crisis is one of the most important issues that humanity faces and there is an evident link between the acceleration of the environmental degradation and the expansion of urban areas (Steffen et al., 2015). According to UN-Habitat, cities are the space where strategies and policies for the protection of the environment should be implemented as urban areas are responsible for the global climate change and a lot of the environmental issues people face worldwide (UN-Habitat, 2018). Also, as most of the human population lives in urban areas, cities are the space where citizen actions towards a more sustainable future can be organized. Sustainability is a complex challenge for humanity which is gradually becoming more and more urgent (Steffen et al., 2015). One of the main problems that urban areas face is pollution which leads both to a dangerous living environment for its inhabitants and has an impact on the global climate crisis (Steffen et al., 2015).

Urban areas could be very important for the reduction of pollution as they are the physical space where most human activity, interactions and communication take place (UN-Habitat, 2018). Therefore, it is possible that in urban areas citizens are more likely to collaborate and act collectively in order to study, manage, preserve or change their living environment. In the working research paper on participatory urbanism «Participatory design of people-centered cities: exploring a future research agenda» by the transition research institute DRIFT, it is stated that «cities contain the necessary resources, spaces as well as interconnectedness of various actors, sectors and infrastructures that will help stimulating deep transformations towards more just, livable and sustainable urban habitats» (von WirthRach 2019). The public spaces of cities are the physical space where public discussion on urban issues can be held and collective action against pollution can be organized through the active participation of different actors.

The main hypothesis of this master thesis is that participatory research and practice in urbanism can be an effective tool to better understand, analyze and possibly decrease pollution in urban areas. With the implementation of participatory methods, the inhabitants can be included in research and in urban projects in order to express their needs and support the professionals with their own experience and knowledge (IAP2, 2020). This hypothesis is based on the idea that their experience can provide with very useful additional information even if it is different from the conventional methods of pollution measurements. Participatory methodologies are a way to learn from the inhabitants and develop inclusive urban projects that incorporate the people they most concern (IAP2, 2020). Participation of citizens in the public discussion for urban space can provide the researchers and the professionals with useful information and insights on the ways they protect themselves or avoid various types of pollution. Through the active participation of citizens, many environmental and social issues of a city can be put to the forefront of research in order to address the problems that inhabitants face and find ways to ameliorate their quality of life (Teixeira et al., 2017). A second hypothesis is that pollution can affect the way people live in the city, the way they use public spaces and the way they move in them. Urban public space is a fundamental element of urban societies and the way people use it can form different types of social relations (Stavrides, 2022). Some types of pollution could affect the way people experience urban public space and therefore the way they use it or move in it.

Embodied Ecologies programme

The data collection for this master thesis is based on my internship in the European Research Project «Embodied Ecologies», conducted by the Wageningen University in Amsterdam, Netherlands with an ERC Advanced Grant. Embodied Ecologies is a multidisciplinary research project that addresses «planetary health problems that have been chronically overlooked and require urgent attention through collaborative and interdisciplinary research» (Wageningen University 2022). Embodied Ecologies is set in three Western European and two Southeast Asian cities. The first part of the Embodied Ecologies project is an ethnographic research on the ways people who live or work in polluted environments perceive pollution, how they protect themselves from it and how they act against it. The research involves participatory methodologies such as alternative mapping in order to collect information from the inhabitants' experiences and understand the impact that pollution has in various aspects of their lives.

The area of analysis for the internship and the case study for this master thesis is Grenoble, a city that faces multiple pollution issues and at the same time has very active citizens in terms of local environmental and social initiatives. More specifically, the study will focus on how the participants

understand and perceive pollution in the different neighborhoods of the city, what are the effects of the exposure to different types of pollution on their everyday life and how this exposure affects the way they dwell urban space. The main mission of the internship was to conduct 16 in-depth interviews and produce sensorial maps with inhabitants of Grenoble, focusing on their perception of different types of pollution. The internship also included a three-day training in Amsterdam. The training took place in the 19th, 20th and 21st of February. The main aim was to organize the research teams for each city, to define the research objectives for the different urban contexts and to complete a theoretical and practical training on sensorial mapping. For the Grenoble case study, a coherent questionnaire for the interviews was created and a theoretical foundation for the sensorial mapping exercises was set in Amsterdam.

Research Question

The research question of this master thesis is based on the main hypothesis. The aim is to examine whether participatory practices in the field of urban studies can be an effective tool to better understand, analyze and possibly decrease pollution in urban areas. As a first step in participatory practices, one of the methodologies implemented for the data collection is sensorial mapping with inhabitants of Grenoble. The research question of the master thesis is: «Can sensorial mapping, as an initial participatory practice, become a tool for the analysis and reduction of pollution in cities?». The master thesis focuses on participatory practices in both urban studies research and urban planning practice in order to highlight this important but not common methodological approach. Since the first urban theories appeared in the 20th century, participation has been an element that appears mostly in theory and not in practice (MacDonald, 2012). Specifically, since the 1960s many academics and theorists of urbanism and architecture, have pointed out the importance of participation of the inhabitants in urban projects (MacDonald, 2012). Psychologist Kurt Lewin introduced the idea of participatory research while other theorists, such as philosopher Paulo Freire, developed the idea by analyzing its potential benefits for urban environments (MacDonald, 2012).

The main research question of this master thesis is followed by four research objectives:

1. The first objective is to study different types of participatory methods and practices through bibliographical research and case study analysis in order to understand which practices are the most effective with citizens, especially in the context of polluted contemporary cities.
2. The second objective is to understand which participatory methodologies can provide spatial

information. This master thesis focuses on urban space and therefore, it is important to study how participation can help in the understanding of urban space from the point of view of the inhabitants.

3. The third objective is the definition of the differences and the similarities in the inhabitants' perception of pollution and urban space, in different neighborhoods of Grenoble. In this part of the master thesis sensorial mapping will be implemented for data collection in collaboration with inhabitants of the city.

4. The fourth objective is to study how pollution affects the way people dwell urban space. This part of the master thesis will also be realized with the participation of Grenoble's inhabitants through interviews and sensorial mapping.

Methodology

In order to understand the phenomena of participatory urbanism and participatory research, the methodology that is chosen for this master thesis is qualitative. More specifically, for the collection of data three different methods are used. The first method of data collection is bibliographical research and case study analysis. In the first chapter there is a historical and theoretical analysis of participatory practices in urbanism. At the end of the chapter there is the analysis of two case studies of participatory and community-led urbanism projects in order to collect information on the techniques and methodologies used in each project as well as their results.

The second method of data collection is part of the Embodied Ecologies programme. 16 in-depth interviews with inhabitants of different neighborhoods of Grenoble were conducted between February and June 2023. This ethnographic research provides qualitative data regarding the experiences of the participants on pollution in the city and specifically in their neighborhoods as well as their perception of pollution in the urban space. The participants vary in age, gender and backgrounds something that leads to answers with diversity and many different points of view. Through this method of data collection, it is possible to focus more on the social and human aspect of urban space through the experiences of the participants. Through the analysis of the interview transcripts, information regarding the individual experiences of urban space and the perception of different types of pollution is produced.

The third method of data collection is sensorial mapping of Grenoble with the participants. During the interviews, the participants are engaged in a sensorial mapping exercise in which they were

asked to give spatial information about their personal experience of pollution in their neighborhood as well as in other areas of the city. The exercise is guided by specific questions on the types of pollution they perceive, the locations in which they are more or less perceptible, their intensity and the psychological or physical effects it has on each participant. The given information is represented graphically on two maps, one of the city and one of the participant's neighborhood. During the exercise, the participants were encouraged to use different colors to represent spatial information but also their emotions and senses regarding pollution in their neighborhood or in areas of the city that they frequently visit. The sensorial maps and graphic information collected from this exercise is analyzed, compared and combined in new sensorial maps in order to understand the participants' perception of pollution in the city. More specifically, the sensorial maps produced by the participants are juxtaposed in order to spatially trace the differences and similarities in the information given by the participants and make new observations.

Chapter 1. Urban space, urban commons and participation theoretical framework

This part of the master thesis aims to provide a theoretical framework for the perception of urban space, the notion of urban commons and the importance of participation in urban practices. The subject of participatory urbanism will be analyzed through relevant literature, theoretical bibliographical research as well as through specific case studies which provide information of the different methods, techniques and results in urban projects. The aim of this part of the master thesis is to understand the history and theoretical background of participation in urbanism as well as its relevance to contemporary polluted cities.

Human activity has been gradually increased in urban areas, especially since the middle of the 20th century (Steffen, 2021). This increase in human activity it is strongly linked to urbanization (Steffen et al., 2015) and has a lot of negative impacts on the natural environment and the climate such as land degradation, loss of biodiversity and pollution of the natural and the urban environment (UN-Habitat, 2018). All these effects impact the health and well-being of humans but are mostly damaging the natural environment and the biosphere (Steffen, 2021). The constant growth of contemporary cities leads also to an economic growth which attracts more and more new citizens and further urban sprawl (UN-Habitat, 2018). The ecological as well as the social systems of human societies are facing multiple issues as they are unsustainably developed over the years (Steffen et al., 2015). However, it is possible that cities develop in a sustainable way, which covers the needs of their systems while preserving the natural environment and not causing further damage to the climate (UN-Habitat 2018; Steffen et al., 2015).

More than half of the global population will be living in urban areas by 2030 and this percentage will continue growing in the next decades (UN-Habitat 2019). Because of the rapid urbanization and the global climate crisis, urban areas are facing very serious disasters. Today, many cities have issues such as air pollution, noise pollution, heat islands and flooding while the big concentration of inhabitants makes the need of solutions urgent (UN-Habitat 2019). According to the United Nations' Sustainable Development Goals for cities that was published in 2019, there is the need to «make cities and human settlements inclusive, safe, resilient and sustainable». One of the main goals for sustainable cities is to focus on sustainable urbanization, on the enhancement of the capacity for participation of citizens in urban projects, on the creation of safe and sustainable human settlements and on the reduction of the general impact of cities on the environment focusing mostly on air pollution and waste management (UN-Habitat 2019).

It can be concluded that as the urban population increases, sustainability is a key element in order for the inhabitants of cities to have a safe and healthy living environment. The lack of sustainability and resilience of urban areas not only has damaging effects on the natural environment but also has many negative effects on the quality of life and health of urban dwellers (Díaz et al., 2006). One of the main goals of sustainable development is to ensure a safe living space in which people have a good quality of life (Díaz et al., 2006).

In cities, the quality of life and the well-being of the inhabitants consists of health, security, freedom, cultural identity, social relationships and the ability to participate in the formation of their living environment (Díaz et al., 2006). Participation is a term that has many definitions and is used in many different scientific fields. According to the World Bank «Participation is a process by which people, especially disadvantaged people, can exercise influence over policy formulation, design alternatives, investment choices, management, and monitoring of development interventions in the communities» (The World Bank, 1992:2). Another definition of participation describes the term as «an empowering process which enables local people to do their own analysis, to take command, to gain in confidence, and to make their own decisions» (Nelson and Wright, 1995:30).

The participation and involvement of inhabitants in urban projects can address many important social and environmental issues of contemporary cities (Teixeira et al., 2017). Through participation, it is possible to study, analyze and understand the urban space and its issues in more depth through the experiences, needs and ideas of the inhabitants (Díaz et al., 2006). Participation in urban projects of research or development can have a positive impact on the way cities are developed and can possibly lead to the creation of more sustainable and inclusive urban spaces that cover the needs of the local communities (Teixeira et al., 2017).

1.1 Urban space and urban society

In order to analyze and understand participation practices in the urban context, firstly the term «urban space» must be approached theoretically. The contemporary world is characterized by increasing urbanization which results in the creation of an urban society, as a product of the urbanization process (Lefebvre, 2003:14-16). This constantly growing urban space is not only the built areas or the urban agglomeration of cities, it is rather a global phenomenon which includes social relations and is characterized by evolution and transformation (Lefebvre, 2003:14-16). Urbanization is a form of occupation of physical space by a specific population which results in high density, concentration and social differentiation (Castells, 1977). Urbanism can be defined as the study of the urban space,

the interaction between people in urban areas and the social environment of cities (Rodgers, 2020). However, according to Lefebvre (2003), «urban society» refers to the result of industrialization and is a term that can't be strictly defined as a theoretical or literally concept. Lefebvre (2003) argues that it is rather a movement of thought that can lead to urban practices. In cities, where there are various types of transformations such as growth of population and industrialization, urban society can be characterized as a movement of thought (Lefebvre, 2003:1-3).

For sociologist and theorist Manuel Castells, the «urban» is the «new era of mankind» (Castells, 1977). However, in his work he argues that the use of the word «urban» is not only a specific historical era but it also proposes the existence of a specific social context: the urban society (Castells, 1977). Urban society is produced by the city and consequently it also produces other forms of relations such as production, economy and culture (Castells, 1977). Urban space is expressing a centrality, a space of concentration regarding human activity and interactions, where «something is always happening» (Castells, 1977). Both for Lefebvre (2003) and for Castells (1977), the «urban» is a product of mankind that produces both space and society. Urban space is produced from the occupation of space by a population that resides the area while urban society is the product of the interaction between these inhabitants.

Lefebvre (2003) presented urban society as a movement of thought, characterized by transformations. From the beginning of their creation, cities were places of transformation and change (Sheppard et al., 2015). From the initial creation of cities as organized human settlements to the industrial revolution in the 18th century and the fast urbanization of the 19th and 20th century, cities have always been the space for societal change (Sheppard et al., 2015). In the long process of urbanization, cities have been a space for experimentation and collaboration for both local or global top-down initiatives aiming for further development and for bottom-up citizen initiatives aiming to change the dominant regimes (Sheppard et al., 2015). The evolution of cities is connected to social movements related to cultural or political contexts (Castells, 1983). There is an important relationship between cities and their inhabitants, which are most of all the makers of the cities (Castells, 1983). Manuel Castells in his 1983 book «The City and the Grassroots» argues that people and therefore social movements, have the need of a physical space which acts as a basis for them to organize, collaborate and act. The role of spatial relations in the urban context is essential for the mobilization of urban social movements (Castells, 1983). He also argues that throughout history, there is a constant battle for the control of space between the people and the state. If there is a common, generalized goal behind the creation and action of urban social movements, it would be an attempt to change, modify or transform the role of the city in society (Castells, 1983).

1.2 The notion of urban commons and urban atmospheres

Urban areas are complex ecosystems which consist of space, people and infrastructure all connected by and related to institutions (Feinber et al., 2021). After the definition of «urban space» a question that rises is what is the role of participation in the formation of urban space and which urban spaces can be created or transformed through participation. The answer to this question can be the notion of «urban commons», a term that describes the urban space which is collectively perceived, used or dwelled (Kornberger and Borch, 2015). An urban common can also be described as a material, immaterial or digital element that is shared between people in an urban environment (Feinber et al., 2021). This element is produced through the interaction between people and actors in a city (Feinber et al., 2021). Therefore, it can be stated that interaction and possibly collaboration an integral part of the creation of urban commons in a city.

In urban studies, the notion of commons is thoroughly analyzed in multiple academic works, however there is not a single definition for it (Feinber et al., 2021). Urban commons can be described as a phenomenon of interactions and relations between the human activities (Kornberger and Borch, 2015). Also, urban commons can be the process of a transformation in society related to sharing and collaboration between people (Feinber et al., 2021). In any physical space and therefore in a city, the first thing that people share is the atmosphere. In urban studies literature, there is a theoretical term which expresses this initial shared element, called «urban atmosphere». This term was mainly developed by two German philosophers Peter Sloterdijk and Gernot Böhme (Kornberger and Borch, 2015). According to Sloterdijk, a city consists of spatial settings named «spheres» which can be physical spaces such as streets or even beliefs and ideas shared between the inhabitants of a city (Kornberger and Borch, 2015). He argued that a sphere initiates an urban common, or more specifically a collective phenomenon in a specific urban space (Kornberger and Borch, 2015).

According to geographer David Harvey, air is a natural element that is shared by all the people while other elements such as streets and land are not available to everyone (Harvey, 2012:71). In the context of polluted and highly urbanized cities it is interesting to think of air as one of the most important urban commons while it is one of the most polluted by human activity (Kornberger and Borch, 2015). According to Böhme, the urban atmosphere is created from the inhabitants' individual experience of reality, which is also shared between them (Böhme, 2014:58). The urban atmosphere is collective and can't be individually used or exploited (Kornberger and Borch, 2015). Additionally, urban atmospheres are enhanced by the existence of a dense urban environment (Kornberger and Borch, 2015). Finally, a term that expresses the procedure of the collective creation and utilization of the urban commons is the term «commoning» (Feinber et al., 2021).

Urban commons can be organized in different categories or sectors. In Diagram 1 there is a representation of the different types of commons and more specifically the traditional commons, the neighborhood commons, the global commons, the health commons, the cultural commons, the infrastructure commons and the knowledge commons (Feinber et al., 2021). This diagram is an adaptation of the «commons sectors» diagram in the research paper «Diversity and Challenges of the Urban Commons: A Comprehensive Review», issued in the International Journal of the

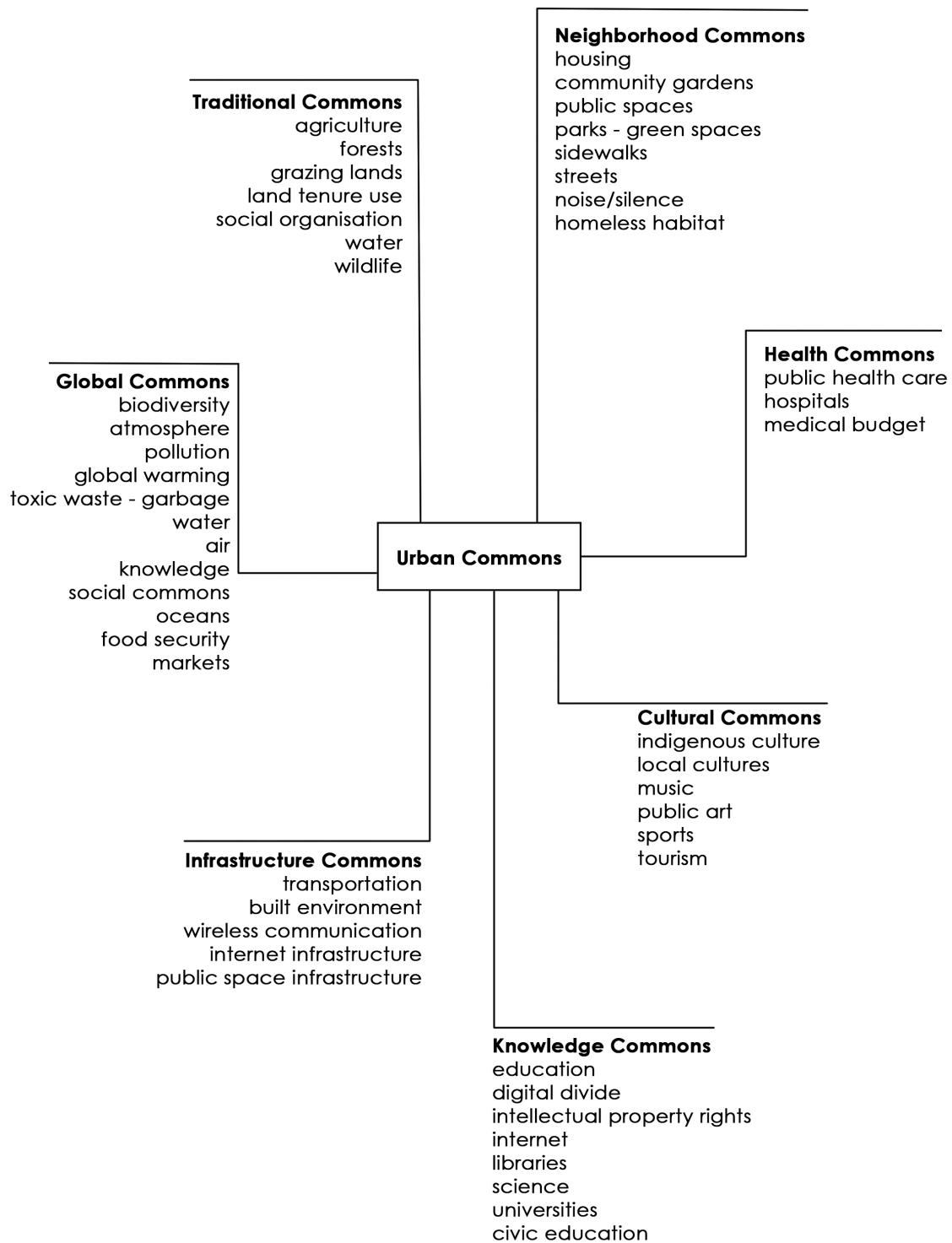


Diagram 1: The map of Urban Commons. (Feinber et al., 2021).

Commons in 2021. In the diagram there are different categories and types of urban commons that are interconnected. For example, the global and the traditional commons, which include the natural elements of air and water, are related to the cities spatially and functionally (Benfield, 2017). To explain that further, air is an urban common that is present in all the physical spaces of a city (spatial relation) while water can be both naturally present in some physical spaces but also it can be provided to buildings through infrastructure (functional relation).

Urban areas contain the needed physical space to host or produce urban commons while providing spaces that are interconnected spatially, economically and functionally (Benfield, 2017). Urban commons are created by the local community when it is creative, open and inclusive (Stavrides 2022) and common urban space is created by the active involvement of the people who use it, in its production and maintenance (Benfield, 2017). Sharing is the most important characteristic of the common space and it is achieved through the equal participation of the commoners in the decision-making processes which have a horizontal organization (Stavrides, 2022). Finally, public urban space is an urban common that has the potential to be collectively used and managed (Stavrides, 2022) and also has the capacity to host other urban commons (Feinber et al., 2021).

From this analysis, it is concluded that there is a strong connection between the production of urban commons and the participation of people in the process. The role of participation in the formation of urban space is important due to its connection with the production of urban commons. Today, most of the resources in cities are polluted and the collective perception of the urban space is highly affected by pollution (Benfield, 2017). Moreover, pollution itself can be considered as a type of urban commons which is a product of human activity (Benfield, 2017). Finally, it can be stated that public space has both spatial and functional relations to other urban commons. Regarding pollution, public space can be the physical space where pollution, such as air pollution from road traffic, is produced. Also, it is the space where people collectively perceive pollution and at the same time it could become the shared urban space where people act against pollution as a process of transformation.

1.3 Participation in urbanism

Participation is a concept in which multiple actors are involved in decision making processes (Wulz, 1986). The different actors involved can be professionals, citizens, political actors or institutions and in order to have a true participatory procedure, members from all sections of a community must be able to get involved (Wulz, 1986). It can also be defined as a process in which the public is involved in decision-making and problem-solving with the goal to make better decisions for

the local community (IAP2, 2020). The main goal of participation is that the people that are most affected by a situation are able to influence or change the decisions and the products of these decisions (IAP2, 2020). According to Arnstein (1969) citizen participation is another term for «citizen power». Through participation power is redistributed between different stakeholders and everyone is involved in determining what are the goals for the community, what policies are implemented, what programs are facilitated and how information is shared (Arnstein, 1969). In a community, participation can provide the members with the opportunity to have control over the actions that affect their lives (IAP2, 2020). Finally, in order to implement participatory methodologies in urban projects, a dialogue between the citizens and the public officials is required. Through dialogue, the opinions, needs and problems of the community are shared and a common vision or strategic plan can be created (Creighton, 2005).

Participation is often associated with self-organization which is a process of creation of alternative structures within a system (Caneparo and Bonavero, 2016). In urban studies, the term refers to the implementation of the local community's opinions and needs (Caneparo and Bonavero, 2016). Through public participation it is possible to incorporate the needs, values and concerns of the inhabitants of a place in order to make more suitable and effective decisions regarding their living environment (Creighton, 2005). Moreover, the actors are able to take responsibility for their neighborhoods and communities, get involved in the development, the improvement and the maintenance of a place and acquire a deeper sense of community and belonging (Caneparo and Bonavero, 2016). The dynamics emerging from citizen participation in urban projects and in discussions on urban issues are visible in local initiatives that are evolving in many contemporary cities, expressing the needs and the growing complexity of urban societies (Caneparo and Bonavero, 2016).

1.3.1 Participatory methods and techniques

Every methodological approach has specific methods and techniques that apply to its characteristics, aims and limitations (Sanoff, 2010). According to Sanoff (2010), in urbanism there are three main categories of participation techniques. The three categories are «awareness methods, group interaction methods and indirect methods» (Sanoff, 2010). The first category utilizes methods such as publications and articles in newspapers in order to inform the public about the process of a participatory urbanism project. The second category refers to the organization of walking tours in the area of interest with the participants. These walks can be accompanied by maps on which the participants can note thoughts, ideas and impressions (Sanoff, 2010). Finally, the third category includes questionnaires and surveys in order to collect information from a specific part

of the population and understand their experiences in an urban context (Sanoff, 2010). The final category of indirect methods can have important limitations regarding biases and personal views of the professionals or the participants. It is common that questionnaires or surveys contain the views and the personal opinions of the people that create them which reflect on the questions and the possible answers, allowing a limited ability for their true individual expression (Sanoff, 2010). Among the methods mentioned, surveys are the most common method of consultation in urbanism. However, this method is not the most suitable to represent the view of an entire community as there are not detailed opinions expressed by the citizens (Arnstein, 1969).

A method that combines the direct results of questionnaires and surveys but also focuses on the personal experience and the individual expression of the participants is in-depth interviews (Sanoff, 2010). This method can provide more detailed information as well as qualitative data that can't be accessed by the indirect methods such as surveys (Sanoff, 2010). Additionally, in-depth interviews can be accompanied by workshops and focus groups that provide even more detailed qualitative data by a specific number of participants. In order for this methodology to be successful it is important to define a specific urban issue and focus on a small part of the local population (Sanoff, 2010). For this master thesis, in-depth interviews are part of the main methodology to collect data regarding the inhabitants' perception of pollution in Grenoble.

According to the United Nations (2001), the participation of inhabitants in urban development projects can lead to more sustainable solutions for cities. The development of urban areas that is often imposed from top-down initiatives can be less sustainable as it does not address the urban issues in depth and it excludes the opinion of the local population (UN-Habitat, 2001). In the UN-Habitat's manual for participatory planning published in 2001, participation is referred to as «participatory reflection and action». This definition expresses the complexity of the concept of participation in urbanism as it includes reflection which is research and thought on a subject and action which is activity, development and change in the urban space (UN-Habitat, 2001).

There are four main principles of the participatory procedures in urban development listed in the manual. The first principle is the collection of data and knowledge by the local people through investigation, analysis and learning (UN-Habitat, 2001). The second principle is that the researchers constantly and critically examine and reflect on their own behavior and possible biases (UN-Habitat, 2001). The third principle is that the researchers as well as the participants acknowledge their personal responsibility as there is not another authority on which the research or the project relies on (UN-Habitat, 2001). Finally, the fourth principle is to share any information and techniques that

are available and could be useful for the procedure (UN-Habitat, 2001). Some further methods and techniques proposed, such as mapping and modeling, institutional diagramming, presentations, do-it-yourself workshops, analysis of secondary sources and participatory budgeting and implementation (UN-Habitat, 2001).

1.3.2 Case studies

The methodologies, theories and results of participation in urbanism have differences according to the characteristics of each city or community. In this part of the master thesis, two participatory urbanism projects are presented. The first case study concerns the community-led renewal of a neighborhood Ljubljana, Slovenia. The second case study involves a research and an urban design project conducted by the architecture and urbanism laboratory Urbana in Athens, Greece. The aim of this case study analysis addresses the first research objective which is to study and understand different participatory methodologies.

Case study 1: Participatory renewal of Savsko naselje neighbourhood in Ljubljana, Slovenia

The first case study of participatory urbanism is a community driven urban project in Ljubljana in Slovenia. The project took place in an economically degrading neighborhood of the city called Savsko naselje, located near the central train station, on the northern part of the city. This neighborhood is mainly residential with most of the buildings being built in the 1940s (Poljak Istenič, 2019). Due to an increase in the housing stock during the 1970s the neighborhood faced economic and social challenges due to the increase of rent prices and the economically diverse population (Bole, 2008). During the last few decades, the neighborhood also had issues with safety, violence and illegal activities. All the above led to abandonment and deterioration of the public spaces, as well as the residential buildings and the schools of the neighborhood which subsequently led to the decrease of the inhabitants' quality of life (Poljak Istenič, 2019).

The reinforcement of the local community in the neighborhood was first an idea from a local artist who decided to promote his new music album in the neighborhood as a public event. The event took place in 2010 in a schoolyard, and it has become an annual gathering in the following years (Poljak Istenič, 2019). This initial event was the first attempt to use a public space of this neighborhood for a community gathering and a collective activity. After the event, some local associations showed interest in the cultural life in Savsko naselje and some interest groups began collaborating with local cultural initiatives (Poljak Istenič, 2019). In 2013, the City of Ljubljana was also interested in the social

and cultural activities that took place in the neighborhood and funded different types of renewal projects in public spaces. Some of the projects included the rehabilitation of small green parks and the renovation of playgrounds and public space infrastructure (Poljak Istenič, 2019).

The first official project funded by the City was the community-led renewal of several public spaces in the neighborhood (Poljak Istenič, 2019). This project was realized in collaboration with a cultural association called Prostorož (Poljak Istenič, 2019). The association engaged with various participatory methodologies and techniques for the funding of the project and the definition and design of the urban renovation. Additionally, in order to engage the local community to participate in the project, the association organized picnics in the few green spaces between the residential buildings (Poljak Istenič, 2019). The picnics were cultural events with music and discussions between the inhabitants and the members of the association with the help of 3D maps of the neighborhood. The inhabitants were encouraged to draw or write their ideas and wishes for changes in their area on the 3D maps (Poljak Istenič, 2019).

An other methodology implemented by the members of the association was semi-direct interviews with the local population regarding the most important problems they face in their everyday life (Poljak Istenič, 2019). This qualitative research led to the conclusion that the most important issues are the lack of green spaces and public furniture as well as the traffic in the streets of the neighborhood (Poljak Istenič, 2019). All the urban renewal projects were created based on the needs and issues that arose from the discussions and the interviews. The design, construction and management included the inhabitants as well, making them part of each step of the progress until 2016, when the project was concluded (Poljak Istenič, 2019). Due to the active participation of the inhabitants, the project was successful and after 2016 a second funding was given by the Creative Europe Project «Artizen» (Poljak Istenič, 2019). This funding was aiming to support the design of a new traffic strategy to address one of the main problems of the neighborhood: traffic and air pollution. Also, through this funding further renovations of the local schools and playgrounds were realized. Finally, the renewal of the urban public spaces led to further private renovations in the residential buildings of the neighborhood (Poljak Istenič, 2019).

In this community-led urban renewal project, there were mainly spatial interventions in the public spaces of the neighborhood. These interventions were designed according to the needs of the inhabitants with the important financial support by the City of Ljubljana and the «Artizen» European project (Poljak Istenič, 2019). According to the inhabitants of the neighborhood, today they have a better quality of life due to the accessible and lively public spaces created by the community (Poljak

Istenič, 2019). It is evident that their participation in the renewal project and the different urban renovations that took place in the neighborhood, gave more meaning to the local community and engaged more people in the public events. An important factor to the success of the project was the participation of the Prostorož association as one of the most important actors (Poljak Istenič, 2019). Their team focused on the issues raised by the inhabitants, collected information and collaborated with them in every step of the project (Poljak Istenič, 2019).

Case study 2: «Inclusive Schoolyards» urban project in Athens, Greece

The second case study of participatory urbanism that will be analyzed is a smaller scale urban project in Athens, Greece. This project was organized and conducted by an architecture and urban planning laboratory, URBANA, founded in 2019 in Athens. Their team consists of architects, social and political scientists and educators working on urban projects that focus on inclusivity and participatory decision-making (Grigoriadou et al., 2021). Also, the laboratory acts as a connection for communication between citizens and local authorities regarding urban projects (Urbana, 2023). With projects mainly focused on urban regeneration, their multidisciplinary team approaches urban space through participatory methodologies and tools and they aim to highlight the importance and benefits of participation (Grigoriadou et al., 2021). The project chosen to be analysed in this part of the master thesis is called «Inclusive schoolyards» and is a research project that led to a participatory urban intervention in elementary schools of Athens.

Athens is the capital of Greece and the largest city of the country (Falireas 2017). The city faces many other problems due to urbanization and the absence of sustainable urban planning such as road traffic, air pollution, high density of built areas and lack of green public spaces (Falireas, 2017). Many of the city's neighborhoods have been further degenerated in the past decades due to the economic crisis (Urbana, 2023). This deterioration of neighborhoods and public spaces highly affects the minorities of the city as well as the people that spend more time in their homes such as elderly people and children (Urbana, 2023). Even though the public spaces are not well maintained, the inhabitants of most neighborhoods use the common urban areas in their everyday life for socialization and gatherings (Grigoriadou et al., 2021).

A public space that is primarily used by children is the schoolyards of primary schools. These open public spaces host neighborhood events related to the school and the families of the neighborhoods while they are also an everyday gathering space for both children and adults (Grigoriadou et al., 2021). URBANA studied schoolyards as in-between urban spaces which have the capacity to

enhance social interaction in the neighborhoods of Athens. The project is separated in two parts. In the first part the team studied and analyzed the schoolyards and the small public spaces connected to primary schools in different neighborhoods of Athens (Urbana, 2023). Through this research the team tried to understand whether these urban spaces cover the needs of the users and if they can host community activities effectively (Urbana, 2023). Also, in the research paper «Analyzing the potential of small-scale public spaces adjacent to primary schools of Athens as drivers of more child-centered urban practices» published in 2021, it is stated that the public spaces around the schools have the potential to accommodate further educational and cultural activities that would enhance the sense of community in the neighborhoods (Grigoriadou et al., 2021). The main research questions stated in the article were if and how the public spaces of primary schools be transformed into urban spaces that host community activities and how these public spaces can be re-designed in order to host safely children's' play as well as enhance the sense of community for adults (Grigoriadou et al., 2021).

For the data collection, the research team engaged in participatory research methodologies. More specifically the main methodology used was experiential participatory action research (PAR) while secondary sources such as interviews and participant observation provided with more data. Due to the pandemic COVID19, the participatory part of the research was delayed and the interviews took place online (Grigoriadou et al., 2021). The results of the research show that schoolyards and the public spaces connected to primary education schools have the potential to host activities and gatherings that could enhance the sense of community in the neighborhoods of Athens (Urbana, 2023). Additionally, it is concluded that it is important for the community that the neighborhoods have spaces for children intergraded in the public realm. It is proposed that local stakeholders should engage more in participatory procedures that include the inhabitants of the neighborhoods for the renewal of schoolyards but also the public spaces around schools and playgrounds (Grigoriadou et al., 2021). One of the main issues raised was the lack of maintenance in the existing play areas of the neighborhoods. It is proposed that the active involvement of the citizens and more specifically children, in the design of the public spaces through participatory practices (Grigoriadou et al., 2021). This can provide with important information about the needs of the inhabitants and the issues they face in the public spaces. At the same time, the participation can encourage the inhabitants to become more active in the utilization and maintenance of these spaces (Grigoriadou et al., 2021).

Following the participatory action research, Urbana Lab proceeded to a participatory urban intervention in schoolyards of different neighborhoods. The title of the project is «Inclusive schoolyards» and its main purpose is to highlight the importance of equality and inclusion in the

school environment through participatory planning and small-scale architectural interventions. Schoolyards are the first public spaces that children socialize and involve with other people. However, in most schoolyards phenomena of exclusion and hierarchy are observed. Through participatory design workshops with the children as well as the teachers of primary schools the space of the schoolyards was redefined a more inclusive space that addresses everyone's needs was designed (Grigoriadou et al., 2021). The choice of primary schoolyards as the space of intervention is very important because, as it is stated above, schoolyards are the first public space children come in contact with. This project suggests that if this first experience of public space is characterized by inclusivity, equality and creative use of space, children might seek or even create this type of public spaces in their future adult life.

«Inclusive schoolyards» was first implemented in the year 2018-2019 in the neighborhood of Kipseli in the 45th Athens Elementary School. 24 students participated in the project which had a total duration of five months (Urbana, 2023). The tools that were used for this procedure were maps and diagrams of the schoolyard on which the children could draw their feelings, needs or visions for the space (Urbana, 2023). Discussion between the classmates was also an important part of the process which led to a list of priorities for change and improvement in the infrastructure of the yard. For the visualization of the final interventions, the members of URBANA and the participants created drawings, collages and a physical model of the new schoolyard (Urbana, 2023).

1.4 Participatory research

“There is no single, objective reality, there are multiple realities based on subjective experience and circumstance”

(Wuest, 1995:30)

Participatory research is methodological approach on many different research fields and is part of the Participatory Action Research (PAR) methodology. PAR is an option for qualitative research which is characterized by equity and democracy regarding its methodologies, aims and results (MacDonald, 2012). The philosophy of participatory research is developed around the idea that people have the right to control and affect their development (Attwood, 1997). Through participatory research, the urban space is transformed in a space of knowledge and communication where the inhabitants can work with researchers and professionals (MacDonald, 2012). The main purpose is to understand a situation and describe it by giving voice to the people involved rather than researching a subject based on subjectivity (MacDonald, 2012). According to the UN-Habitat (2001), the participation of inhabitants in urban development projects can lead to sustainable solutions for urban areas.

It is true that the urban development that is realized from top-down initiatives is often less sustainable as it does not address the urban issues effectively (MacDonald, 2012). The inhabitants of urban areas that need changes regarding environmental or social issues could be part of the solution through participation (UN-Habitat, 2001). In the UN-Habitat's manual for participatory planning published in 2001, participation is referred to as «participatory reflection and action», a term is expressing the complexity of the concept in the urban context (UN-Habitat, 2001). Participatory research focuses on the collection and analysis of data in collaboration with various actors and has the purpose of social change (MacDonald, 2012). Through action research the researcher can collaborate with the members of a community with the common goal of improvement of their situation (MacDonald, 2012).

The history of PAR begins with the work of German-American psychologist Kurt Lewin (MacDonald, 2012). Lewin first discussed the importance of peoples' involvement in the decision-making processes in their workplace in order to be motivated and interested in their work and professional field (MacDonald, 2012). He introduced the term «action research» as a method or a tool to study social systems with the aim of changing it (MacDonald, 2012). Furthermore, the history of PAR has roots on the work of Brazilian philosopher Paulo Freire (MacDonald, 2012). According to Freire, it is crucial to engage in critical reflection in order to achieve social or personal change (MacDonald, 2012). He argued that the marginalized communities and other members of society could be empowered through participatory practices and action research (Freire, 1970). Important issues and challenges that affected specific parts of the population such as poverty and illiteracy could be addressed and solved through participatory action research (Freire, 1970). As an educator and author, Freire critically addressed the social power relationships in traditional education, which result in inequalities (MacDonald, 2012). Finally, social movements of the 20th century developed the idea of participation in research communities of various disciplines such as social sciences, international development and education (MacDonald, 2012). Researchers linked to these social movements, such as feminist theorists and researchers, studied and implemented participatory research in their work understanding the importance of collaboration between the participants and the researchers (Maguire, 1987).

In our days, participatory research has become a methodology for many different scientific fields such as sociology, philosophy, anthropology and urbanism (Wadsworth, 1998). Historical, geographical, political and economic factors are important when applying participatory research in order to understand in depth the context of the research (Wadsworth, 1998). The participants are involved actively in the process and can affect the collected data, actions and results (Wadsworth,

1998). Additionally, the power in decision-making processes is equally distributed to different actors by engaging them in the research process (Maguire, 1987). The implementation of participatory research on issues of urban communities is a collective process which involves the inhabitants and engages them in public discussions (Maguire, 1987). Through the interaction between the participants and the researchers and a common understanding of the urban challenges there is the possibility to create an educational process for all the people involved (Wadsworth 1998). According to researcher Patricia Maguire, through collective action there can be both short and long term changes in urban communities (Maguire, 1987). Additionally, she stated that the participants, as members of the local community, can understand that through active engagement in collective discussion and action could firstly notify their problems and secondly lead to positive transformations of their living environment (Maguire 1987).

Any type of research methodology has its strengths and limits. In the case of participatory action research there are multiple strengths as it is a radical form of research that challenges the conventional research methods. First of all, PAR values people's knowledge and it involves them in the research process as active contributors. It puts of the important data the individual experiences of the participants on the forefront of research, giving them the opportunity to be heard (MacDonald, 2012). Moreover, the participants are not only a subject of research but are also important contributors to the procedure (MacDonald, 2012). According to Maguire (1987), participation enables individuals to be active in meaningful decision-making processes. When they participate in research related to their problems, needs and their living environment, they are able to become active actors and have the opportunity to form their own life (Maguire, 1987). Additionally, through the participation of multiple actors there is collaboration between professionals and non-professionals who can provide with diverse information on a topic and therefore, the development of knowledge can be more inclusive (Maguire, 1987). Finally, it is important to mention that participatory research has the goal to empower people and communities that are oppressed or marginalized (MacDonald, 2012).

However, there are also limitations in the approach as well as criticism for its efficiency. Firstly, the engagement of the participants is voluntary and this creates an uncertain work plan in which their commitment in every step of the research is not sure (MacDonald, 2012). Moreover, the diverse participants and multiple actors engaging in a research project could lead to many different perspectives. While this is a wanted result, it can also become a limit when many contradicting values, opinions and needs (MacDonald, 2012). Participatory research requires a lot of engagement not only from the participants but also from the researchers because as it has many different stages it lasts longer than conventional research methods (MacDonald, 2012). Finally, a common criticism

is that it is not legitimate enough for scientific research as it does not focus on facts but on individual or collective experiences (MacDonald, 2012).

The main values related to participatory research are empowerment, equity, social justice, collaboration, learning and respect (Ochocka et al., 2010). The first value is empowerment, a value that promotes knowledge as a means to give power and voice to community members (Ochocka et al., 2010). Equity and social justice reflect the possibility of social change and improvement of the quality of life for communities (Kidd and Kral, 2005). Collaboration refers to the process in which different people learn to communicate effectively, share information and accept knowledge from others while conducting research (Sherwood and Kendall 2013). Moreover, effective collaboration and good relationships between the actors often lead to better and more productive decision-making (Sherwood and Kendall, 2013). Learning is one of the most important values of participatory research as it provides new knowledge, skills and information to all the participants and the researchers on a long-term basis throughout the stages of the research (Kidd and Kral, 2005). Finally, respect towards diversity is crucial, especially for urban research that is based on multicultural societies (Ochocka et al., 2010).

1.4.1 Sensorial mapping & radical cartography

Sensorial mapping or sensorial cartography is a methodology of radical cartography which is often a method utilized in participatory urbanism and participatory research (UN-Habitat, 2001). Radical cartography does not have a clear definition as the term refers to many different methods of mapping in various scientific fields. Radical cartography can be considered as an attempt to represent the world in another way (Rekacewicz, 2021). There are various names used to describe the term such as are sensorial, participative, alternative, collective, experimental or counter-cartography (Rekacewicz, 2021). The main purpose of sensorial mapping is to highlight information that is not usually visible in contemporary maps and put on the forefront of research important issues, expressed in new radical ways. According to Harris and Hazen, radical cartography questions the norms and biases in conventional cartographic representations and challenges the power of mapping in general (Harris and Hazen, 2005:115). Experimental mapping methods have been also used to highlight non-visible spatial inequalities (Rekacewicz, 2021). Radical cartography first appeared in the 1960s as a means to fight for social justice in marginalized and poor urban communities (Rekacewicz, 2021). In the recent decades, alternative mapping projects have emerged in many urban environments in an attempt to research many different themes such as security, surveillance, social and spatial justice and consumption (Rekacewicz, 2021).

In the contemporary world, through the new technologies and the social networks, alternative methods of cartography have been digitalized and explored in new scientific fields (Rekacewicz, 2021). The creation of sensorial maps involves groups and individuals that are not usually part of the conventional cartography and are not a part of powerful institutions (Dalton and Stallmann, 2018). The main difference between conventional mapping and sensorial mapping is that conventional mapping is focusing on the representation of specific information and not human experiences while sensorial mapping aims to include human experiences, perceptions and feelings and to highlight important social, economic or environmental issues that are not visible in conventional mapping representations (Rekacewicz, 2021). Radical cartography and sensorial mapping highlight the importance of new ways to see the city and the complex socio-spatial relationships that form in the urban space (Dalton and Stallmann, 2018).

Sensorial mapping is used as a method of data collection, along with in-depth interviews, for the exploration of human experience and the perception of various types of pollution in urban environments in the Embodied Ecologies research programme. Addressing the second research objective on which participatory methodology can provide spatial information, sensorial mapping is chosen as one of the data collection methods for this master thesis. Through the exploration of urban space with maps and diagrams, the participants will be encouraged to represent visually their experiences and perceptions of pollution and how it affects their everyday life in the city.

Chapter 2. Urban pollution

Contemporary cities face many issues related to the global crises such as the environmental, social or economic crisis (UN-Habitat, 2018). One of the issues that needs to be addressed in the contemporary urban environments is pollution. Inhabitants of small, medium or large urban areas and cities are constantly exposed to various types of pollution in their everyday life (Steffen et al., 2015). Additionally, pollution has a negative impact on the global climate crisis (Steffen et al., 2015). It is a major factor of environmental issues such as global warming and loss of biodiversity, especially because of the amount of CO₂ emissions that is produced in cities (UN-Habitat, 2018). There are multiple types of pollution in urban environments such as air, noise, soil, light and water pollution that can be harmful to humans and to the natural environment within or around cities (UNEP, 2017). Most of the inhabitants of polluted cities are exposed to diverse types of pollution every day, a situation that can affect their health and in general their quality of life (Martínez-Bravo and Martínez-del-Río, 2019). Therefore, pollution is a factor that determines the quality of life, sustainability and health of inhabitants in urban areas. This chapter of the master thesis is focused on different types of pollution in urban areas and the role of urbanism and urban planning.

2.1 Pollution in urban environments and the role of urbanism and urban planning

As mentioned in the previous chapter, the increasing human activity and urbanization has a lot of negative impacts on the natural environment (Steffen, 2021), as well as in cities with social and environmental challenges (Steffen et al., 2015). After the industrial revolution, most of the world's population is living in urban areas and this phenomenon has been expedited in the past decades due to many different factors (Kirabo Kacyira, 2012). Urbanization can be considered also a factor that has facilitated human life providing comfort and amenities (Piracha and Chaudhary, 2022). However, high levels of pollution are an inevitable outcome of high urbanization and human activity in urban areas which results in unhealthy and polluted living environments for the urban dwellers (Piracha and Chaudhary, 2022). One of the most important issues related to urbanization and human activity is pollution which appears in different types, levels and intensity (Piracha and Chaudhary, 2022).

In order to describe the different types of pollution observed in cities the term «urban pollution» will be used. Urban pollution consists of various harmful or toxic substances that are produced by human activity and have negative impacts on human health and on the natural environment (Martínez-Bravo and Martínez-del-Río, 2019). According to Goel the levels of pollution in cities is directly connected to the density of the population (Goel, 2006). Cities with dense population, dense built environment and high levels of human and industrial activity, present higher levels

of various types of pollution (Martínez-Bravo and Martínez-del-Río, 2019). Even though pollution is partly a result of high urbanization, urban areas are the physical space where change regarding sustainability can be initiated (Martos et al., 2016). Because of the high density of the urban population, it is possible that if cities reduce their levels of pollution and gradually become more sustainable, it is possible that there will be a big positive impact worldwide (Martínez-Bravo and Martínez-del-Río, 2019).

Urbanism and urban planning have a very important role in the formation of urban environments. The organization and design of public spaces, facilities, transportation systems and the management of urban areas have a great impact on the quality of life of the local communities (Piracha and Chaudhary, 2022). Many urbanists and architects have highlighted the importance of people-centered cities that are designed to meet the needs of the local population. According to architect Jan Gehl, there is a link between the human health and the urban planning of cities (Gehl, 2010:111). In his book «Cities for people», he analyses the ways in which urban space can affect human behavior. More specifically, he supports that urban planning and urban design provide the inhabitants with opportunities for different activities (Gehl, 2010:9-14). If a city provides its citizens with open green spaces, pedestrian areas and bike lanes, it is probable that they will engage in these activities and habits. On the contrast, if a city is built based on traffic roads, people will mostly use cars (Gehl, 2010:9-14). Conclusively, the design and planning of the urban space can promote or restrict certain behaviors and habits of the local population.

Considering that human behavior has a strong impact on the levels of pollution in cities, it can be concluded that urban dwellers have the power to shift the pollution levels in their living environment and that urban areas with dense population can be the physical space that hosts this positive change. An example of a city in which urban planning enhanced sustainability through changes in the inhabitants' way of life is Copenhagen, in Denmark. Copenhagen was initially an industrial city in the 19th century



Figure 1. Bike lanes in Copenhagen.
(Visit Copenhagen, 2023)



Figure 2. Public spaces with large pedestrian areas.
(Thandi Norman, 2023)

which was transformed into a neighborhood-friendly city, with a strong focus on accessible public spaces, pedestrian streets and bike lanes (Figure 1,2) during the 20th century (Florian, 2023). The city's plan to achieve carbon neutrality has been successful with an 80% decrease while at the same time it is considered a laboratory for people-centered urban planning (Florian, 2023).

Another very important example regarding people-centered urban planning is the case of Barcelona in Spain. The aim of this urban planning strategy was to improve the quality of life in the city by reducing air pollution and by creating more green public spaces in each neighborhood (Mueller et al., 2020). This urban planning strategy called «Superblocks» (Figure 3) aims to create socially engaging neighborhoods where pedestrian movement is prioritized. In more detail, the superblocks consist of nine city blocks in which there is no vehicle traffic in order to reduce air and noise pollution (Mueller et al., 2020). At the same time, the new pedestrian streets that are created inside the superblocks promote a collective use of public space and enhance the feeling of community (Mueller et al., 2020). Local authorities can have a crucial role in the reduction of pollution (Martínez-Bravo and Martínez-

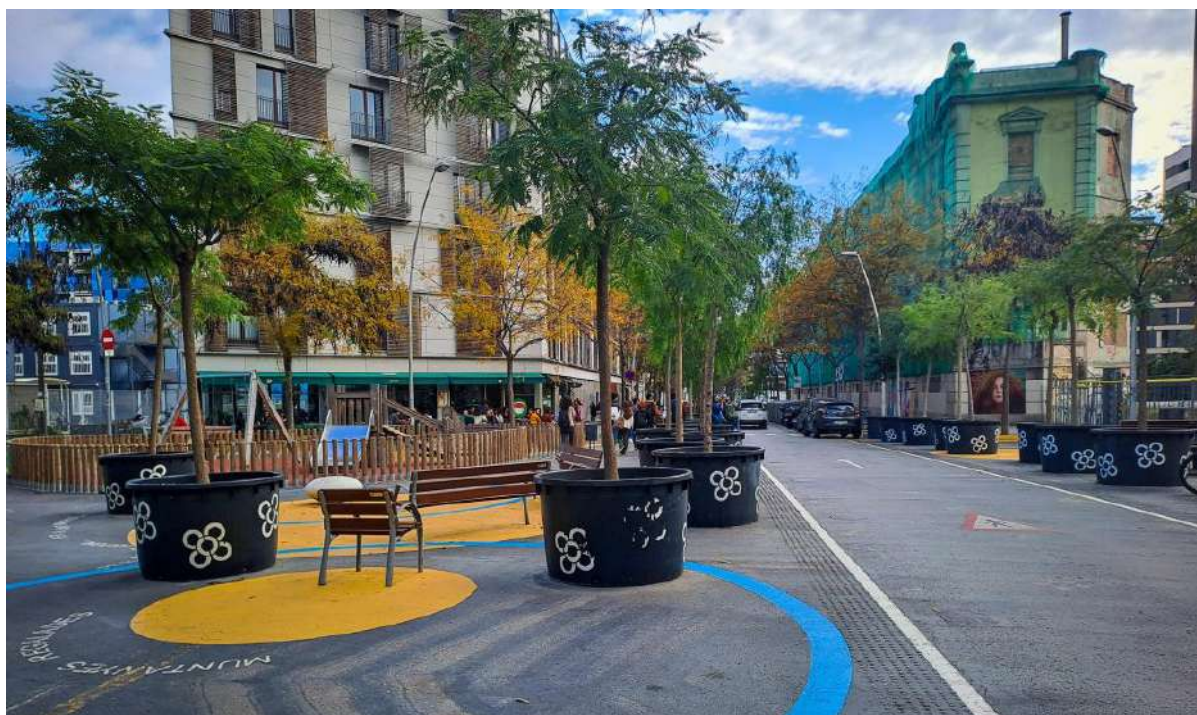


Figure 3. Pedestrian area of the superblocks system in Barcelona. (Castrezzati, 2023).

del-Río, 2019). Through the decisions and actions of the local authorities there could be maintenance of the public space infrastructure, management of the main pollution sources such as traffic and implementation of regulations and policies towards sustainability (Martínez-Bravo and Martínez-del-Río, 2019). Through the implementation of local regulations in cities, it is possible to limit air, water and soil pollutants that are in direct contact with the inhabitants of polluted neighborhoods (Martínez-Bravo and Martínez-del-Río, 2019). Additionally, local authorities can influence the

inhabitants to get involved and participate in pollution reduction through policy programs in order for sustainability to become a priority for the inhabitants (Martínez-Bravo and Martínez-del-Río, 2019). Conclusively, both local governments and the inhabitants of cities can contribute to the reduction of pollution through changes in policies and in the way of living while urban planning can effectively contribute in the promotion of sustainable practices and habits for the urban population.

Finally, it is also important to mention that environmental injustice in urban areas is a very common phenomenon related to the spatial distribution of green spaces, blue spaces, wealth as well as environmental and health hazards such as the exposure to high levels of air pollution (Zander et al., 2023). Also, access to goods, services, public spaces and commons is often not distributed equally between citizens due to socio-economic differences. In order to achieve social and environmental sustainability in cities, it is important to reduce these spatial inequalities (Zander et al., 2023). In our days, the climate crisis has introduced even more hazards for urban areas such as urban heat islands and floods (Zander et al., 2023).

While the excessive exposure to environmental and health hazards, mostly related to pollution, is a situation often observed in many cities of the Global South, a similar situation is observed in large cities of the Global North due to the increasing and fast urbanization (Zander et al., 2023). In Europe, the relation between the socio-economic status of citizens and their exposure to urban pollution differs between different cities (Morelli et al., 2016). However, the levels of exposure to air pollution are higher in the low or intermediate income population in many urban areas (Morelli et al., 2016). Finally, the different levels of exposure to air pollution between neighborhoods is creating important differences in the quality of life and the health of citizens (Morelli et al., 2016).

An example of a city where environmental inequality is observed is Paris in France (Padilla et al., 2014). In Paris, there is an unequal distribution of green public spaces in different neighborhoods highly related to income while the city faces environmental hazards such as urban heat islands (Liotta et al., 2020). In a study of environmental inequalities in large urban areas of France, conducted in 2014, it is stated that there are contrasting data between Paris, Marseille and Lyon (Padilla et al., 2014). In Paris, the population with the lowest social deprivation is mostly exposed to air pollution. In contrast to Paris, Marseille presents higher levels of exposure to air pollution in the population with higher income (Padilla et al., 2014). In Lyon, the neighborhoods that face the higher levels of air pollution are the ones with intermediate social deprivation (Padilla et al., 2014). The exposure to pollution in urban areas is a social issue related to socio-economic factors and it is important to be addressed by local governments, urbanists and urban planners (Zander et al., 2023).

2.2 Types of pollution in urban environments

In order to study the human perception of the different types of pollution in urban environments it is important to define the different types of pollution. The main types of urban pollution according to the UNEP report published in 2017 are air pollution, water pollution, soil pollution and waste (UNEP, 2017). All these types of pollution are present in both urban and rural areas but they are more intense in urban areas. Additionally, noise and light pollution can be also considered important types of urban pollution for many cities (Martínez-Bravo and Martínez-del-Río, 2019).

1. Air pollution

Air pollution can be considered the most common type of pollution in cities. Air pollution from car CO₂ emissions, which negatively affects the climate, is related to the urban sprawl and the suburban type of living which requires transportation based mainly on cars (Piracha and Chaudhary, 2022). In cities, there is high concentration of particulate matter (PM₁₀ and PM_{2.5}), nitrogen dioxide (NO₂) and ozone (O₃) (European Environment Agency 2022). The main sources of these types of pollution are fossil combustion or fuel (Duche, 2013:11-15). Other common sources of urban air pollution are transportation, waste treatment, power plants, industrial activities and agriculture (Diagram 2) (UNEP, 2017). Due to the urban sprawl, the density and the traffic, urban environments face high levels of air pollution (Martínez-Bravo and Martínez-del-Río, 2019).

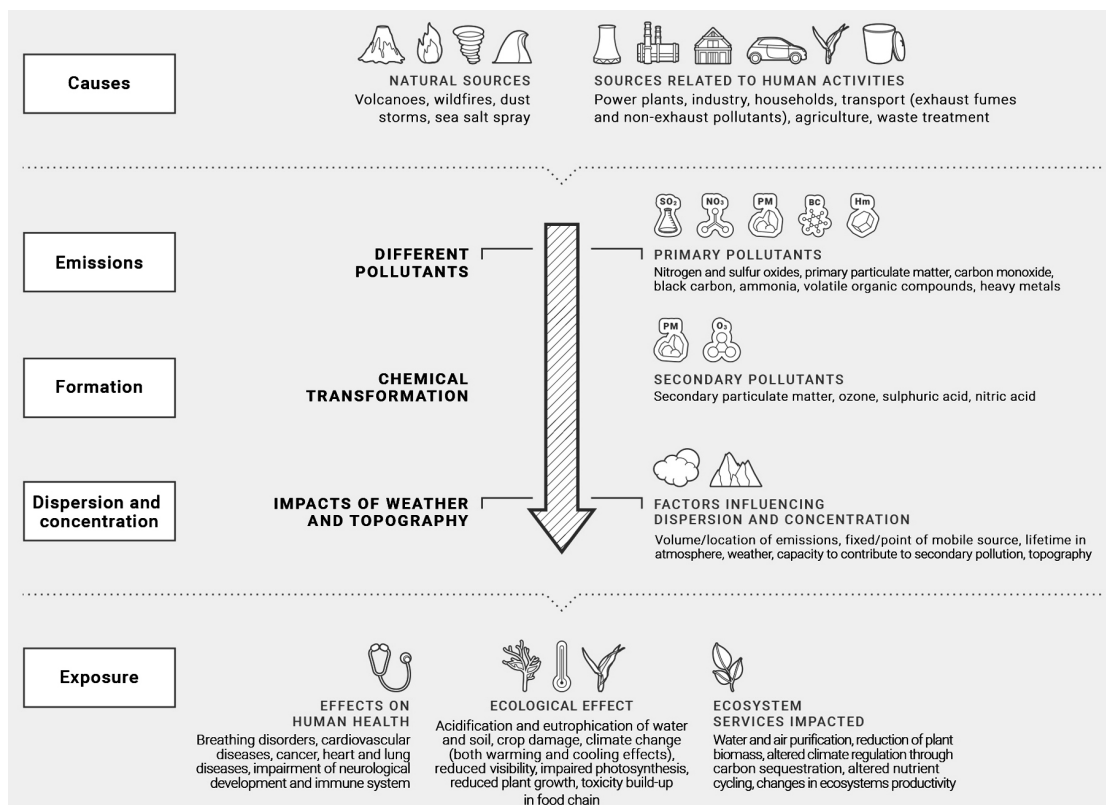


Diagram 2: Air pollution causes and effects. (United Nations Environment Programme, 2017)

2. Water pollution

The water resources for cities are usually ground water resources as well as rainwater (Goel, 2006). Urban areas have a higher demand on water because of the dense population and the industrial activities. At the same time, these activities often lead to the pollution and deterioration of the water quality (Martínez-Bravo and Martínez-del-Río, 2019). Water in urban areas can be polluted through various sources which are also connected to agriculture and industrial activities outside of the cities (Martínez-Bravo and Martínez-del-Río, 2019). The main source of water pollution is chemicals that are released into the water and dissolve in it (Goel, 2006). These chemicals can lead to reactions that often result in water contamination (Goel, 2006) such as the formation of bacteria and parasites (UNEP, 2017). The chemicals that lead to water contamination are usually products of human activities and the sources are usually organic chemicals, metal and plastic waste as well as bacteria and toxins (Martínez-Bravo and Martínez-del-Río, 2019). According to the research paper «Urbanization: an increasing source of multiple pollutants to rivers in the 21st century» (2021), there are many differences regarding water pollution between different countries such as different types of pollutants and different levels of pollution (Strokal et al., 2021).

3. Soil pollution

Another type of urban pollution is soil or land pollution. The main sources of soil pollution can be both natural or anthropogenic (UNEP, 2017). Natural sources of soil pollution can be landslides while anthropogenic sources are waste, industrial activities, wastewater, transportation and farming (UNEP, 2017). Soil and land are two very important features of the urban environment as they support and host spatially all the urban infrastructure. Additionally, urban communities are highly dependent on the land in cities for residential use and for recreational activities (Martínez-Bravo and Martínez-del-Río, 2019). Soil pollution is also connected to water pollution because of the natural biological cycles. The quality of soil can be deteriorated if it is used for urban development like transportation systems or industrial infrastructure (Martínez-Bravo and Martínez-del-Río, 2019). The quality of soil in urban areas is degraded due to various reasons related to both natural phenomena and human activities. Some of these reasons are soil sealing, soil erosion, desertification, soil acidification from the deposition of air pollutants, soil contamination from the deposition of chemicals and waste (Martínez-Bravo and Martínez-del-Río, 2019). All the above lead to soil pollution as well as to the reduction of soil biodiversity (European Environment Agency, 2010). Water, air and atmosphere in urban areas are highly affected by soil pollution which also negatively affects human health (Martínez-Bravo and Martínez-del-Río, 2019).

4. Noise pollution

Human activities and more specifically vehicular movement and traffic in the streets of urban areas, result in high levels of air pollution but are also connected to noise pollution. Noise pollution is also related to the increase of the urban population which leads to more dense neighborhoods with multiple noise pollution sources (Martínez-Bravo and Martínez-del-Río, 2019). Noise is considered a very intrusive type of pollution which can affect the health and well-being of urban dwellers (Martínez-Bravo and Martínez-del-Río, 2019). Moreover, noise pollution has psychological effects on humans. Other health issues such as hearing problems, sleep disorders, stress, tinnitus and cardiovascular diseases are related to noise pollution in urban environments (Maschke, 1999).

5. Waste pollution

Finally, waste is one of the most important issues in urban environments and it is a type of pollution that is constantly increases as the urban population grows (UNEP, 2017). According to the UNEP (2017) there is a direct connection between the income of the urban population and the quantity of solid waste produced. Waste can be separated in different categories such as industrial, construction or demolition, commercial and food waste while there are other types such as agricultural waste and mining or quarrying waste (UNEP, 2017). Additionally, waste pollution is highly related to soil pollution in cities and around urban areas because of waste disposal. It is understood that the various types of urban pollution are interconnected (Martínez-Bravo and Martínez-del-Río, 2019). It is important to mention that there is a connection between the income level of a country and the people's quantity of solid waste (UNEP, 2017). More specifically, it is stated that in countries with developing economies there is lower waste management capacity leading to many health risks for the inhabitants and negative impacts on the urban and natural environment (UNEP, 2017).

Chapter 3. Grenoble case study analysis

The area of analysis for this master thesis is the city of Grenoble. Grenoble is the capital of the Isère department in the Auvergne-Rhône-Alpes region of France and is spread in an area of 545 km² (Aix et al., 2022). The inhabitants of the city were 158.198 in 2019 (Insee, 2023) and approximately 450.000 inhabitants in the agglomeration (Aix et al., 2022). The aim of this chapter is to present and analyze the participants' perception of pollution in the urban space of Grenoble. For the first part of this chapter there is a presentation of the natural topography of the city, the main types of pollution and their sources. In the second part of this chapter there is the analysis of the data collected from the in-depth interviews conducted with inhabitants of different neighborhoods in the city. Also, the sensorial maps created during the internship in the Embodied Ecologies programme are presented, compared and analysed while new maps of the city are created with the utilization of graphic representation tools based on the initial sensorial maps.

3.1 Area of analysis presentation



Diagram 3. Map of Grenoble. (Commune-Mairie, 2023).

Located in a valley of 214 meters altitude and surrounded by three mountains which reach up to 3000 meters in height, Grenoble has a very interesting natural topography (Largeron and Staquet, 2016). The natural topography of the area, the industrial activity in the Isère department and



Figure 4. Grenoble agglomeration and the natural topography of the area. (Green Grenoble, 2022)

the urbanization are the reasons why there are high levels of air pollution in the city (Figure 4) (Largeron and Staquet, 2016). Grenoble is a city that faces challenges regarding pollution, climate change and mobility (GreenGrenoble2022, 2023). In 2022, Grenoble was chosen to become the European Green Capital setting goals regarding pollution reduction, energy efficiency, sustainable use of territory and quality of mobility (GreenGrenoble2022, 2023). Additionally, in 2005, the city adopted a Climate Plan in order to reduce greenhouse gas emissions and from 2005 until 2016, there was a 25% reduction while the goal is 50% reduction until 2030 (European Commission, 2022). However, even though there are multiple projects and strategies organized by the City Council, the Metropole and the Isère Department as well as many citizen actions towards sustainability, pollution remains an important issue in the city.

3.2 Types of pollution and their causes in Grenoble

Grenoble is located on the French Alps (Figure 5), between the mountains Belledonne, Vercors and Chartreuse (Largeron and Staquet, 2016). The natural topography of the mountains is very steep, with many slopes that face the north and the west part of Grenoble (Largeron and Staquet, 2016). The city also spreads between two rivers, the Isère River and the River Drac (Wallenfeldt, 2023). The location of Grenoble in the valley between the three mountains and the two rivers leads to the unique «Y-shape» of the urban area (Largeron and Staquet, 2016). The climate in Grenoble is temperate continental with notable differences between cold winters and warm to hot summers. Additionally, there are frequent rainfalls (Aix et al., 2022).

This natural topography of the area leads to a phenomenon that enhances the pollution levels inside the city. The air pollution is «trapped» in the valley of Grenoble because of the mountains leading to heavy air pollution that is mainly produced from industries in the Isère department (Largeron and Staquet, 2016). The topography of the city that is surrounded by high mountains prevents the air pollutants to «escape» (Largeron and Staquet, 2016). Additionally, the meteorological phenomenon of temperature inversion aggravates the situation when masses of hot prevent vertical diffusion of air pollutants (Aix et al., 2022). Because of the urban sprawl and the high urbanization of Grenoble, there is a secondary source of air pollution. The road traffic inside the city and in the large highways that surround the main urban area, increase the levels of air pollution (Largeron and Staquet, 2016). Moreover, there are periods during the winter months when Grenoble is a point of access to many ski resorts leading to more vehicular movement in the highways and traffic intersections (Largeron and Staquet, 2016).

According to the study «Étude sociologique sur la pollution due au chauffage au bois dans l'agglomération grenobloise : synthèse des principaux résultats» by Stéphane La Branche (2016), the main concern regarding health for the population of Grenoble is air pollution (La Branch, 2016). This study focuses on the air pollution related to wood heating systems of houses and the inhabitant's

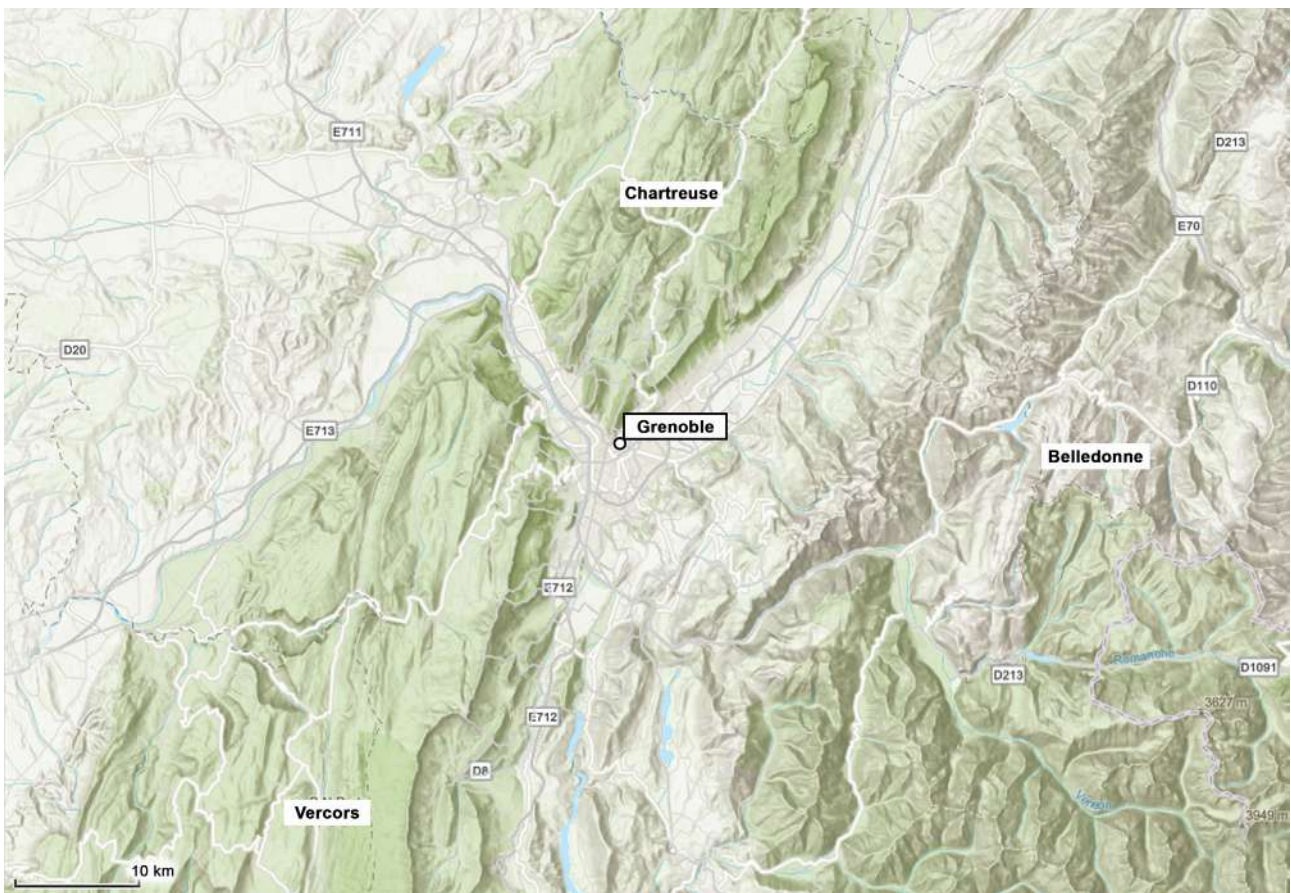


Figure 5. Grenoble is located in the French Alps, between three large mountains. (ATMO Auvergne-Rhone-Alpes, 2023).

perception of individual responsibility regarding air pollution. Most of the inhabitants do not consider wood heating as a major source of air pollution (La Branche, 2016). Approximately 40% of the residents living in the metropolitan area of Grenoble are facing problems with air pollution daily and the local population shows interest in being more informed on the situation in order to understand the risks and find solutions (La Branche, 2016). Industrial activities and waste burning are perceived as secondary sources of air pollution while transport is perceived as the main source of air pollution by the inhabitants of the area. However, according to the study, the pollution levels related to wood heating from houses can reach 62% of the total amount of air pollution during winter months (La Branche, 2016).

A more recent study by Marie-Laure Aix, Pascal Petit and Dominique J. Bicot in 2022, analyses the levels of air pollution and the impacts on the health of Grenoble inhabitants during the Covid19 lockdown. The study presents data from the International Agency for Research on Cancer (IARC) that show the negative impacts of air pollution in the health of urban populations. Air pollution in urban environments is associated with high mortality rates, respiratory and cardiovascular diseases as well as lung cancer (Aix et al., 2022). Finally, Yann Largeron and Chantal Staquet in their study «Persistent inversion dynamics and wintertime PM₁₀ air pollution in Alpine valleys» (2016) examine PM₁₀ air pollution episodes in Grenoble during the winter months. PM₁₀ is an air pollutant dangerous for human health. The main sources of PM₁₀ emission are both anthropogenic and natural. The anthropogenic sources are the most dangerous for human health and are observed in cities and industrial sites (Largeron and Staquet, 2016). Conclusively, Grenoble is an urban area with often air pollution episodes related to the natural topography and the local human activity (Figure 6). The population growth and the industries in the area as well as the traffic in streets and highways lead to persistent levels of air pollution. The various types of pollutants (Figure 7) related to human activity, make Grenoble one of the most polluted cities in France (Largeron and Staquet, 2016).

According to the European Environment Agency (EEA) 2022 report, most of the urban population in Europe is exposed to high levels of air pollution. Many European cities present high concentration of particulate matter (PM₁₀ and PM_{2.5}), nitrogen dioxide (NO₂) and ozone (O₃) (European Environment Agency 2022). NO₂ is released by high-temperature fossil combustion of coal, gas and oil and more often by the combustion of fuel used for transportation (Duché, 2013:11-15). Ozone is a photochemical pollutant and it is considered a secondary atmospheric pollutant (Duché, 2013:11-15). Finally, the aerosols or PM₁₀ and PM_{2.5} are particulate matter suspended in the air and water. The toxicity of PM is related to their size and they can be harmful for human health as they are able to enter the respiratory system. PM₁₀ and PM_{2.5} is produced by anthropogenic activities such as

industrial activities, agriculture and transportation but also from natural processes such as volcanic eruptions (Aix et al., 2022). Most of PM_{10} and $PM_{2.5}$ are emitted by road traffic and wood combustion (Duché, 2013:11-15). Conclusively, the main sources of urban air pollution are anthropogenic, such as emissions from households, road traffic and fossil-fuel combustion (Aix et al., 2022). In Grenoble, according to the air quality indicator ATMO Auvergne Rhone-Alpes, the main pollutant concentrations are particulate matter (PM_{10} , $PM_{2.5}$) and nitrogen dioxide (NO_2).

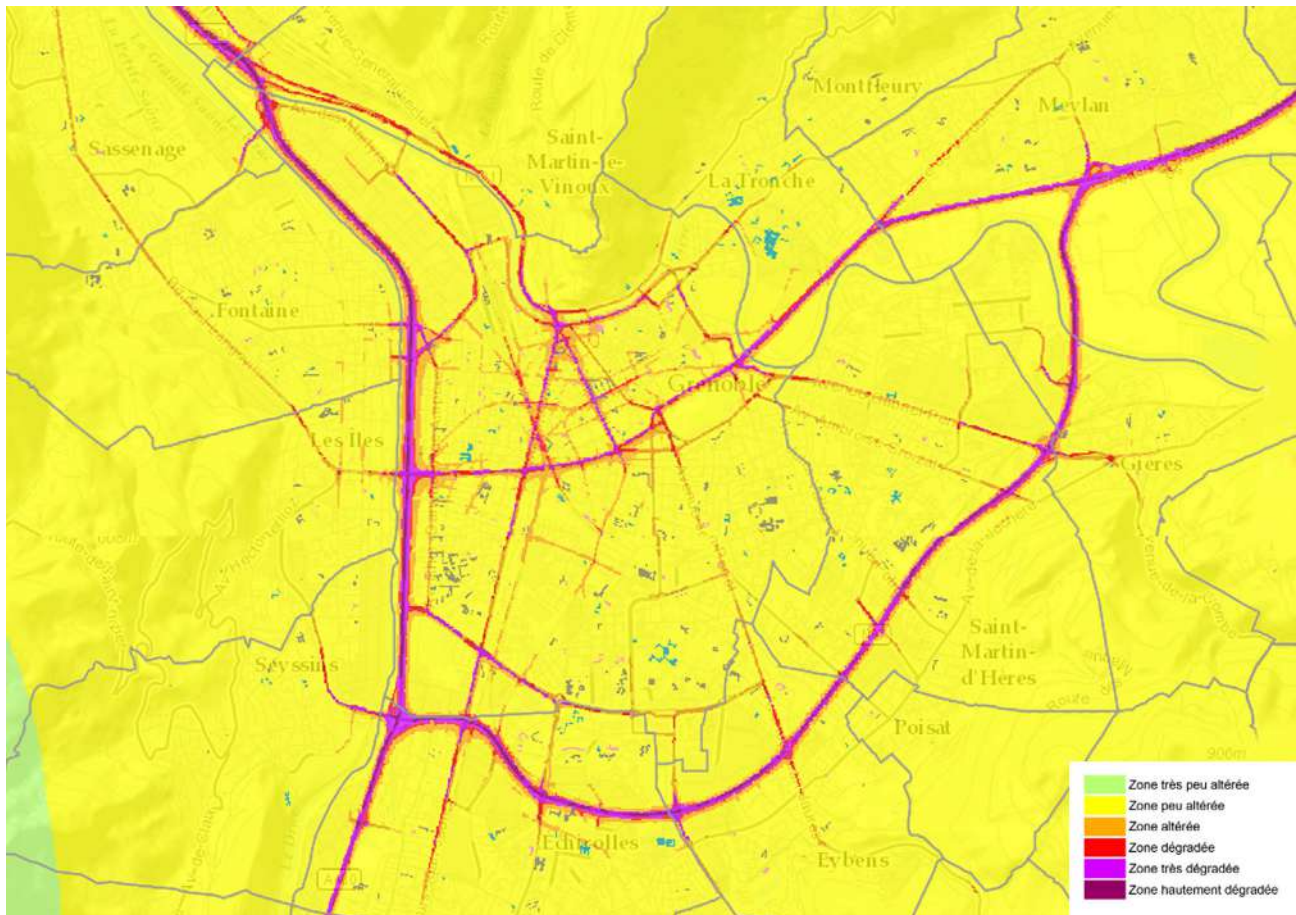


Figure 6. Air pollution in Grenoble. (Orphane, 2023).

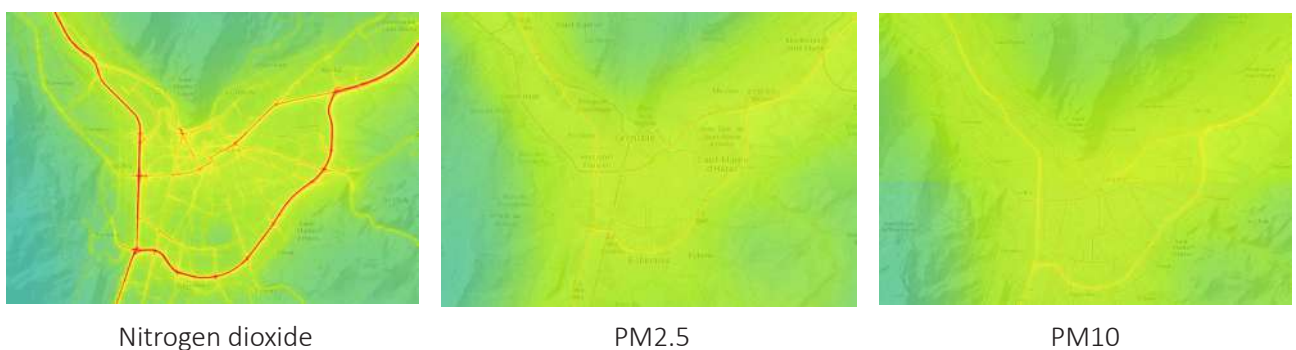


Figure 7. Types of air pollution in Grenoble. (ATMO Auvergne-Rhone-Alpes, 2023).

According to studies, in Grenoble air pollution is the most important form of urban pollution. Most of the inhabitants of the city are either directly affected by it or highly concerned. Most of the inhabitants are regularly informed about the air quality through the air pollution indicators of the city (European

Environment Agency, 2023). However, air pollution is also connected to soil and water pollution. The quality of water resources and soil is highly affected by air pollution because air pollutants are usually deposited on soil and diffused in the water streams (European Environment Agency, 2023). In urban environments, as mentioned in the previous chapter, noise pollution is regular type of pollution that affects the inhabitants. In Grenoble, noise pollution (Figure 8) is also an issue of urban pollution, studied by ATMO with regular measurements that provide information regarding the noise pollution levels and locations (ATMO Auvergne Rhone Alpes, 2023).

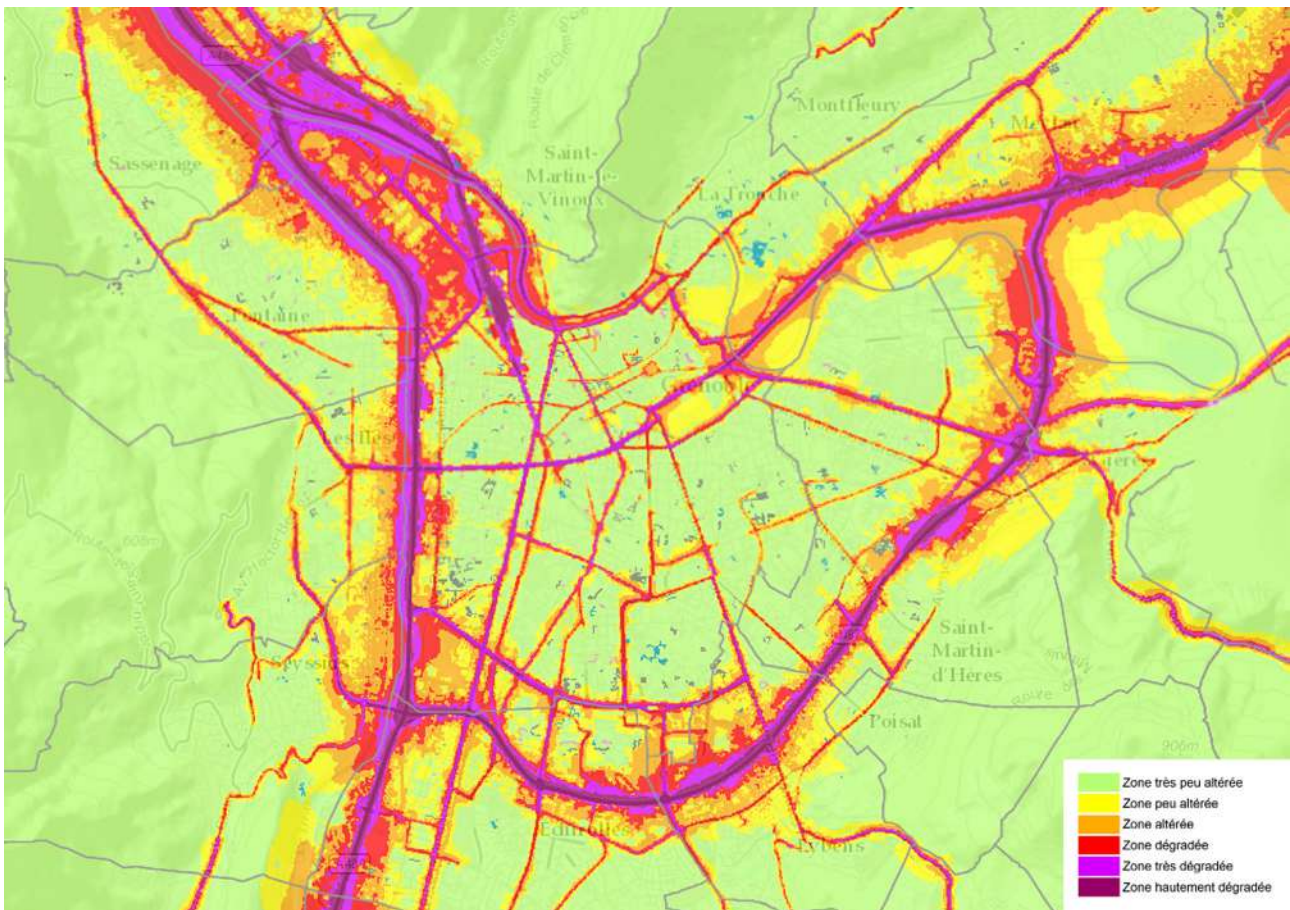


Figure 8. Noise pollution in Grenoble. (Orphane, 2023).

3.3 Analysis of ethnographic interviews and sensorial mapping

The methodology for data collection in this master thesis aims to gather information regarding the way inhabitants of Grenoble perceive various types of pollution. Also, the data collected from the sensorial mapping exercises contribute to the understanding of how the exposure to pollution affects their life and their experience or perception of the urban public space. The ethnographic research consists of 16 in-depth interviews and sensorial mapping exercises conducted with people living in different neighborhoods of the city. The initial goal was that every one of the 16 participants lives in a different area of the city. This methodological choice aimed to be able to study all the

different areas in order to collect data from many different points of view. Through the questions during the interviews, the participants expressed their own individual experiences of pollution in the urban space of Grenoble, specifically in relation to air, water, soil and noise pollution. Additionally, the 16 participants were diverse in gender, age, country or city of origin, length of stay in Grenoble and occupation (Diagram 4). The various backgrounds of the participants and the fact that they live in different neighborhoods of the city could provide with diverse and contradicting information regarding the types of pollution, their intensity or their effects in the urban space. However, during both the interviews and the sensorial mapping exercises, most of the participants had similar experiences regarding pollution in Grenoble as well as a common perception of many urban public spaces of the city. Moreover, most of the participants expressed their worry for the air pollution levels in Grenoble and were thoroughly informed about it. The different neighborhoods of the 16 participants are presented in a map of the city (Figure 9).

The interview guide created for this master thesis was based on the information and discussions that took place in Amsterdam during the internship training in February. The aim was to induce a conversation with the participants in order to have elaborate and detailed responses to the questions. The final questionnaire is separated in two parts. On the first part the questions focus on the background of the participant, the places they have lived in the past and some first impressions on the public spaces of Grenoble. Also, the first part contains information regarding how long the participants have lived in the city. The second part of the interview focuses on different elements

Gender		
female	male	
9	7	
Age		
<30	30-40	45-65
8	3	5
Years in Grenoble		
<5	5-15	>15
9	4	3
Origin		
Grenoble	other city in France	abroad
2	5	9
Occupation		
student	employee	retired
7	8	1

Diagram 4. Participants' socio-demographic data

that might be polluted in the urban environment. The questions explore the quality of air, water and soil, the quality and cleanness of public spaces and green spaces as well as the levels of noise pollution in the participants' neighborhoods and in other areas of the city. Moreover, the questions explore differences in the pollution levels throughout the year and during different seasons. There were also some questions that lead to the sensorial mapping exercise. These questions focus on the types of pollution the participants experience more often or feel the most in the public spaces of the city. Also, the questions explored if and how the participants avoid these types of pollution. For the sensorial mapping exercise, the participants were provided with a printed map of the city, a map of their neighborhood, tracing paper and markers of different colors with which they were encouraged to draw or note their experiences of pollution in their neighborhood, in the areas they visit often, their observations regarding different types of pollution in the public spaces and the main sources of pollution according to their perception or opinion.

The data collected from the ethnographic research, leads to an analytical approach for the third and fourth research objectives of the master thesis. The third objective is to define the differences and similarities in the inhabitants' perception of pollution in different neighborhoods of the city while the fourth objective is to study how pollution affects the way the participants dwell urban space.

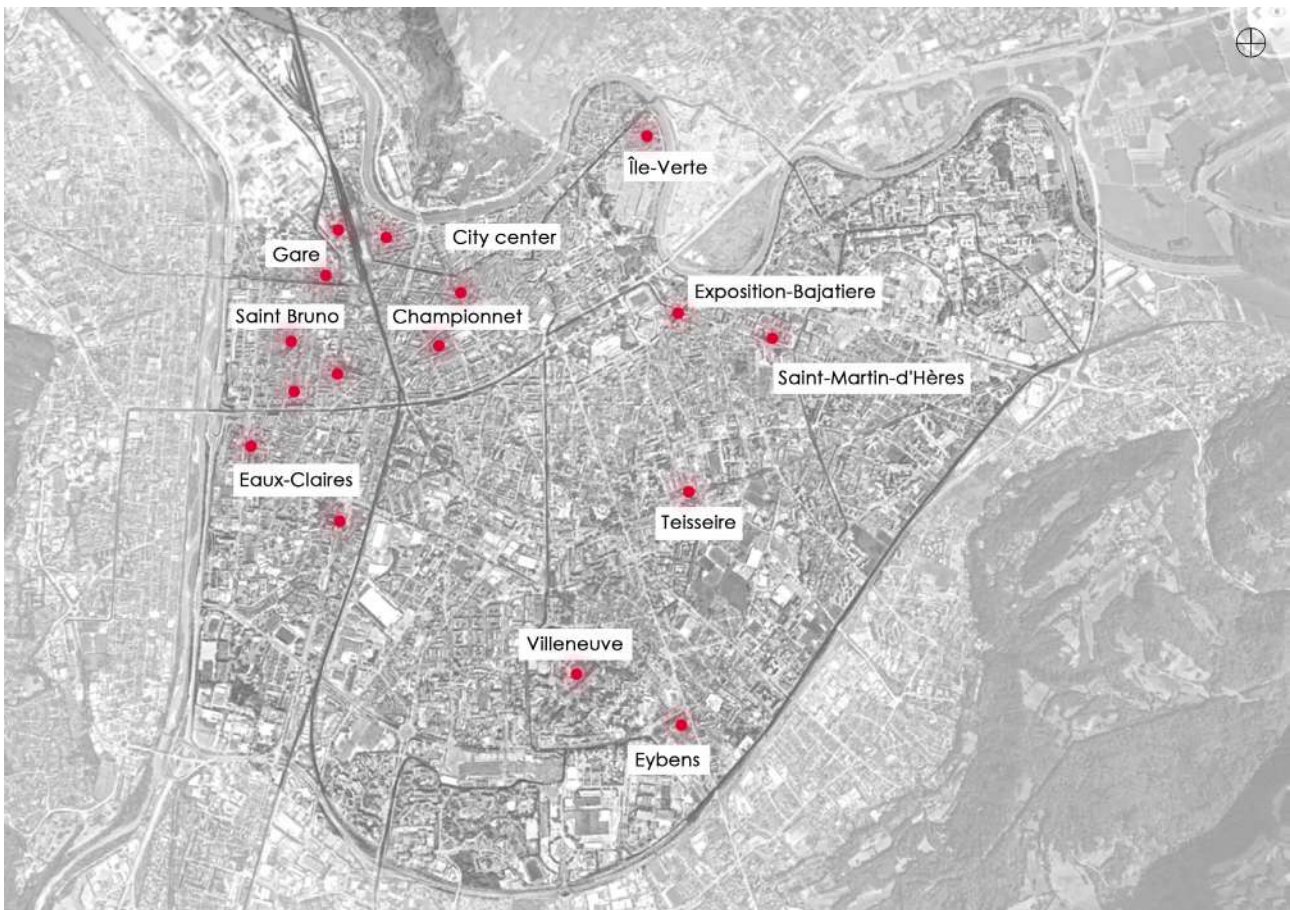


Figure 9. Participants map

The question that arises is whether the inhabitants of an urban area or a neighborhood share a common experience of pollution. Finally, the aim of the collected data analysis is to understand if the participants share a collective experience of the urban space through their perception of various types of pollution.

3.3.1 Ethnographic interviews

In this part of the data analysis there is a comparison of the answers the participants gave during the interviews, regarding the different types of pollution in Grenoble and how they affect their everyday life in the city. Regarding air pollution, 7 out of the 16 participants have developed respiratory issues or allergies related to air pollution and 9 out of 16 experience the air in Grenoble as heavy. All of the participants support that the atmosphere is cleaner when it rains while the air pollution is more sensible during the summer months, when the temperature is higher. Also, 13 out of 16 participants believe that air pollution is the most common and most important type of pollution in Grenoble while 3 out of 16 support that noise pollution is equally important.

Regarding noise pollution, most of the participants associate noise pollution with the bigger streets and road intersections inside Grenoble. More specifically, 12 out of 16 participants consider cars as the main source of noise pollution in the city. The Saint Bruno neighborhood and the center of the city are considered the least calm areas with a lot of noise from traffic. From the interviews, it is concluded that noise pollution is an issue mostly for the older participants that live in Grenoble for a long time and haven't lived in bigger cities. Younger participants and more specifically international students consider Grenoble a quiet city.

Regarding the green spaces of Grenoble most of the participants would like to have more green spaces in their neighborhoods. More specifically, the participants who live on the west side of the city, in the neighborhoods of Saint Bruno and Eaux-Claires, mentioned the lack of bigger parks. 10 out of 16 participants, consider the green public spaces of the city safe and calm. They choose to visit them often for these qualities and in order to escape the air and noise pollution of their neighborhoods. Additionally, most of the participants choose to change their route during the day in order to pass through the nearest park in their neighborhood.

Regarding soil pollution, none of the participants considers the soil of the city polluted or dangerous. However, most of the participants made a connection between soil pollution and waste management in the city. Regarding the cleanness of the public spaces and the waste management in Grenoble,

50% of the participants believe the city is clean and the waste is well managed. The other 50% has the opposite opinion as they live in neighborhoods with a lot of litter in the public spaces. Additionally, 3 of the participants are worried about the burning of waste near the city and they make a connection between waste management and the high levels of air pollution. Finally, regarding the quality of water, all the participants were very satisfied with it. None of the 16 participants uses bottled water and they all have knowledge on the tap water sources in the city.

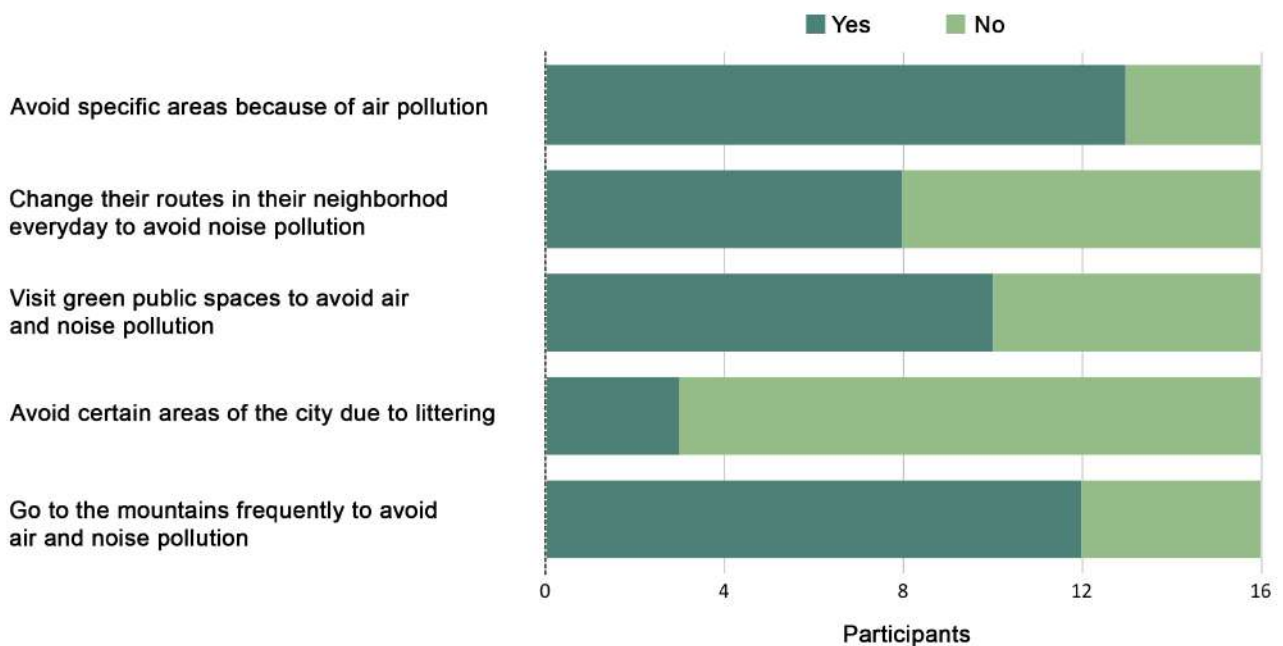


Diagram 5. How pollution affects the way people use public space and move in the city.

One of the questions asked to the participants was about which areas they choose to go frequently and which ones they avoid. Most of the participants avoid specific areas on the south of the city because of safety reasons. However, air pollution, noise pollution and littering are also factors that affect their movement in the city and the areas they visit or avoid. 13 out of 16 participants avoid specific streets in their neighborhoods and some areas in the city in order to avoid air pollution from cars while 50% of the participants are changing their routes inside their neighborhood every day in order to avoid noise pollution from cars or construction sites. In order to deal with air and noise pollution, 10 out of the 16 participants choose to frequently visit the green public spaces of the city while 12 out of 16 participants mentioned that they frequently choose to go to the mountains near Grenoble. Also, 3 participants who live in the neighborhoods Saint Bruno and Eybens, avoid certain areas in their neighborhoods due to litter in the streets and sidewalks.

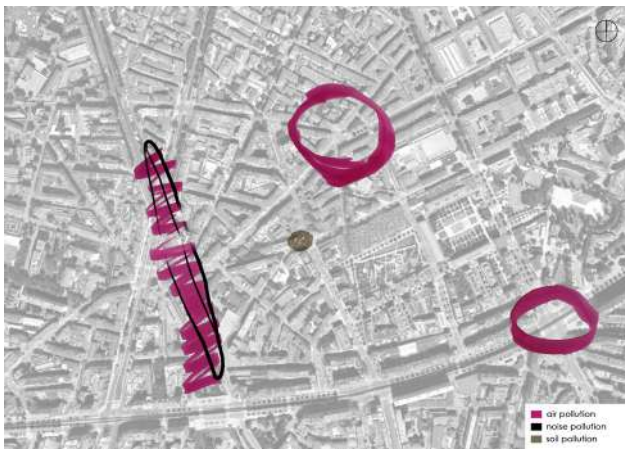
After the analysis of the responses of the participants to the questions, it can be concluded that they all have similar views regarding the types of pollution that affect their everyday life the most. All the

participants share common experiences regarding air and noise pollution, despite the neighborhood they live in while littering is a type of pollution that affects the inhabitants of specific neighborhoods. Finally, they express a common need for more green public spaces in the city.

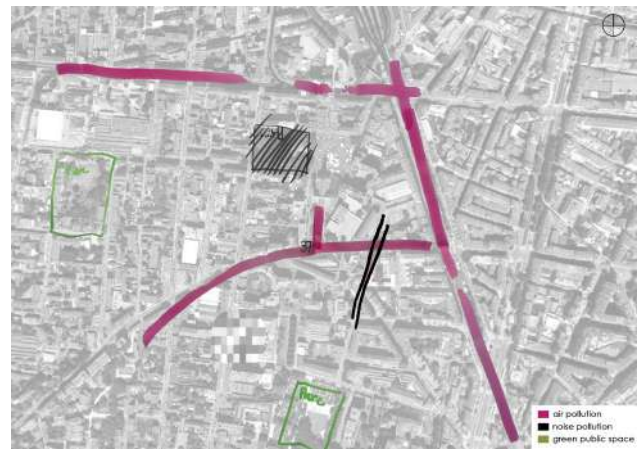
3.3.2 Sensorial mapping

The sensorial maps created by the participants during the interviews focus on their neighborhoods but also in other areas of the city that they frequently visit for various reasons. In these maps, the participants noted the most and less polluted areas of Grenoble according to their experience. They differentiated the types of pollution with the use of colors and they were encouraged to express themselves on the maps freely in order to represent spatially their feelings and experiences of pollution in the urban space. Some of the participants created separate sensorial maps for their own neighborhoods, presenting their experience in a smaller scale (Figure 10). It is evident that even though air pollution is a phenomenon with multiple sources, the participants are mostly affected by it through the traffic in their neighborhood streets. Also, these six sensorial maps show that in the smaller scale of the neighborhood, the existence of parks and public green spaces is vital for the wellbeing of the inhabitants. Between these six participants, only two were content with the accessibility to green public spaces in their neighborhoods and only one visually represented it on the map (3. Eybens neighborhood). The other five participants mentioned the lack of green public spaces in their neighborhoods and their need for more parks within the urban environment also in relation to the high levels of air pollution in the city.

In order to understand the collective spatial perception of pollution between the 16 participants, the sensorial maps of the city created during the interviews, were overlapped in a general sensorial pollution map of Grenoble (Figure 11). This map is an attempt to represent a collective perception of pollution in the city. The overlapping of the 16 maps, creates an elaborate representation of their experience in the urban public spaces. The most prominent information that stands out visually on the map is air pollution while the second is the green public spaces. These two contradicting elements are the ones that almost all the participants decided to represent visually on their individual sensorial maps. This observation highlights the importance of the green public spaces in the everyday lives of the inhabitants in a city with high levels of air pollution. In the interviews, 10 out of 16 participants mentioned that they frequently visit the parks in their neighborhood while 7 out of 16 participants also visit larger green public spaces outside the limits of their neighborhood. Finally, most participants emphasized their need for more public green spaces in the city and mostly during the summer months when temperatures are very high in the city.



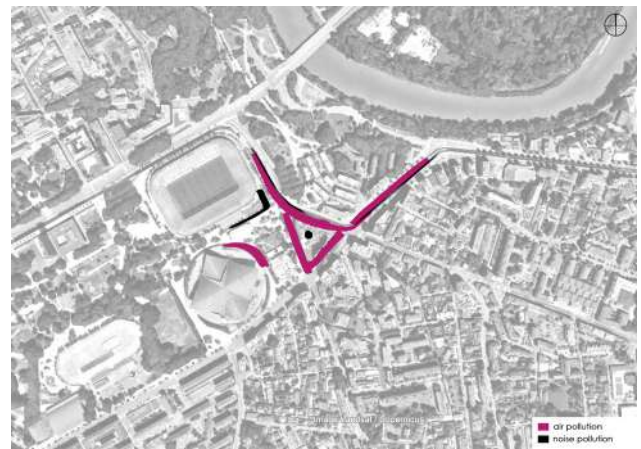
1. Championnet neighborhood



2. Saint Bruno neighborhood



3. Eybens neighborhood



4. Exposition-Bajatière neighborhood



5. Île-Verte neighborhood



6. Villeneuve neighborhood

Figure 10. Sensorial neighborhood maps

The official air and noise pollution maps (Figures 6, 8) have differences and similarities with the sensorial maps. Regarding air pollution, in the participants' sensorial map (Figure 12a) most of the highlighted areas are inside the limits of the city and more specifically in the neighborhoods on the west side of the city. On the contrast, the Observatoire Orhane air pollution map (Figure 6)



Figure 11. General sensorial pollution map

shows higher levels of air pollution mostly on the highways that surround the city. Even though the participants mentioned that cars and road traffic is the main source of air pollution, they are not as affected by the bigger highways as by the traffic in the smaller streets inside their neighborhoods. Finally, the participants whose health is affected by air pollution with allergies or respiratory issues, mentioned that there is a feeling of heaviness in the air in the whole city and not in specific areas.

Regarding noise pollution, the participants' experience is very different from the Observatoire Orhane map (Figure 8). In the sensorial map (Figure 13a) it is evident that noise pollution is experienced mainly in the areas near the center of the city as well as in the intersections of bigger streets with high traffic or public transportation. While the official map of noise pollution highlights the areas where there are higher levels of noise pollution, the participants' experience is different. The highways that surround Grenoble do not affect them directly regarding noise pollution as most residential areas that are not in proximity to these highways. It can be concluded that for this type of pollution, sensorial mapping is an effective method to understand the inhabitants' experience which might differ from the official pollution levels indications.



Figure 12a. Air pollution sensorial map

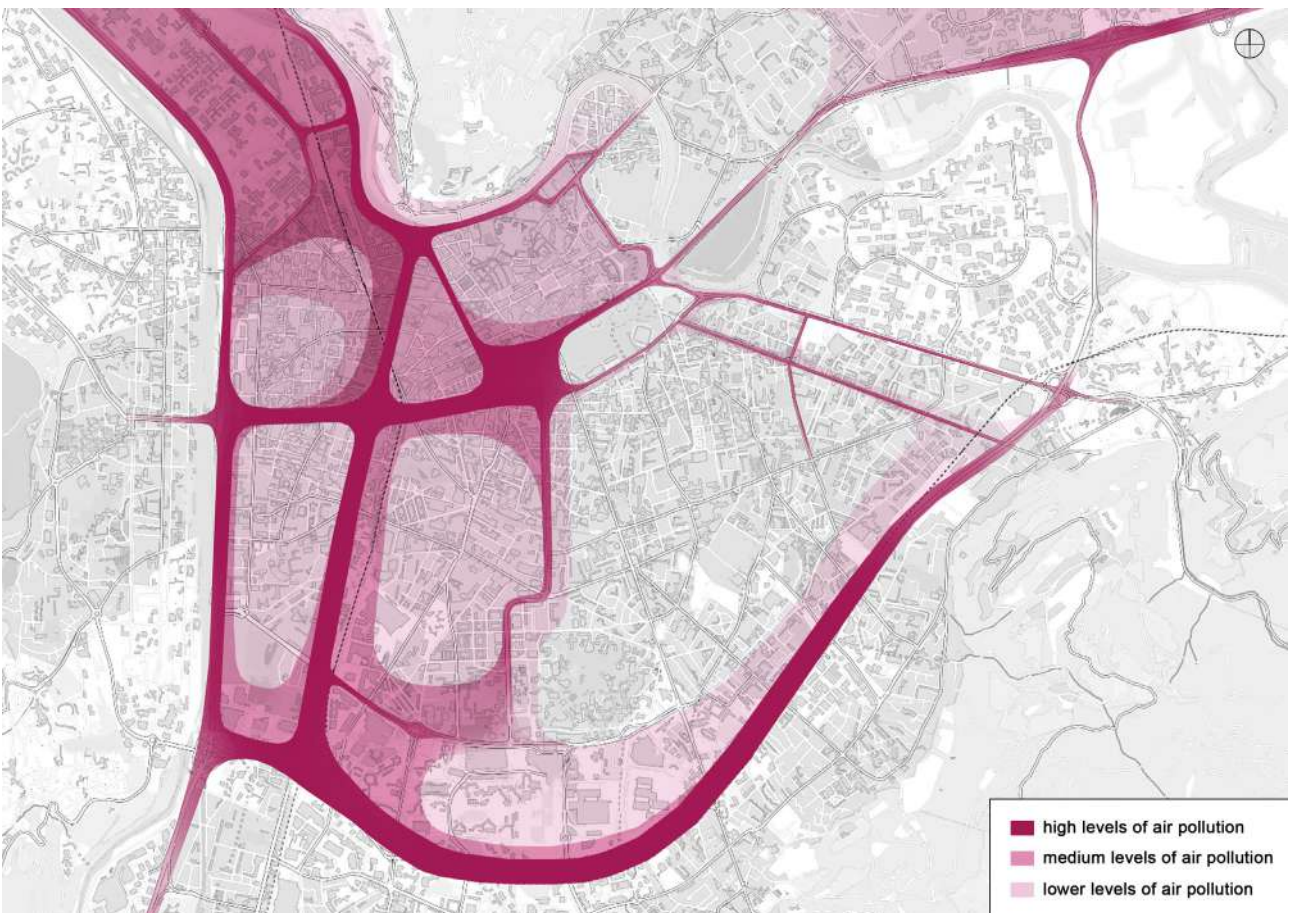


Figure 12b. Air pollution sensorial map graphic interpretation



Figure 13a. Noise pollution sensorial

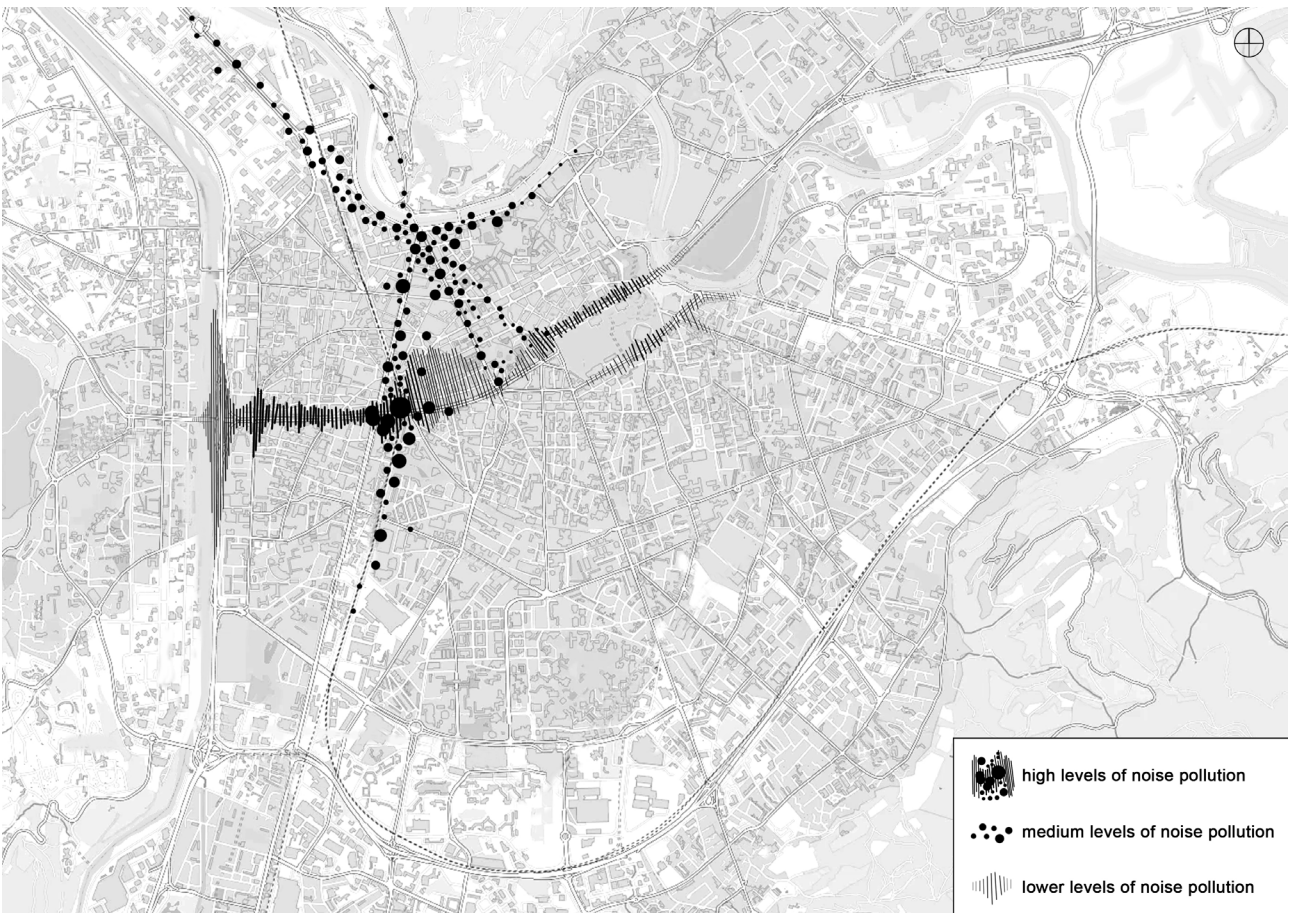


Figure 13b. Noise pollution sensorial map graphic interpretation



Figure 14. Soil pollution - Littering in public spaces

Soil pollution was the least important type of pollution for the participants. Most of them made a connection between the general cleanness of the city and the littering of public spaces with soil pollution. The sensorial map (Figure 14) created for soil pollution mostly focuses on two areas of the city, the neighborhood of Saint Bruno and the neighborhood Capuche-Alliés.

Finally, there are some public spaces where the participants experience air and noise pollution in a smaller degree, the larger parks of the city. In these green public spaces, most of the participants notice less noise pollution, less sensible air pollution and less heat during the summer months. Additionally, these green spaces allow them to interact with other people and participate in community events or activities such as the shared gardens. In the sensorial map (Figure 15) the green public spaces that the 16 participants frequently visit are overlapped in a new sensorial map. The participants emphasized the importance of green public spaces in their neighborhoods but they are mostly visiting specific larger green areas on the north and east side of Grenoble. In the following map (Figure 16) the green public spaces which were represented in the sensorial maps or discussed during the interviews are completed by other smaller parks of Grenoble which are not mentioned by the participants.



Figure 15. Sensorial map of green public spaces the participants frequently visit

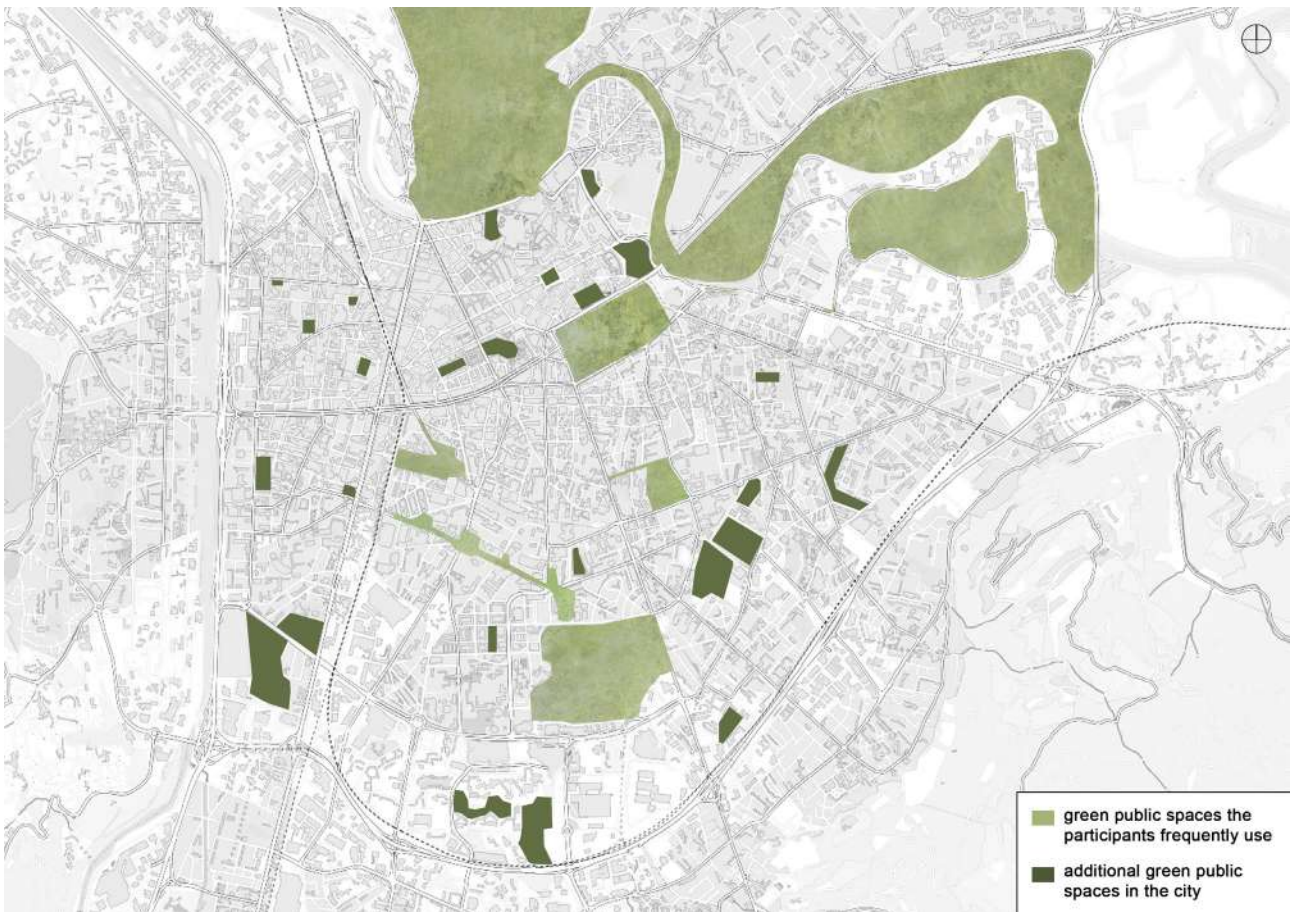


Figure 16. Map of green public spaces in Grenoble

According to the sensorial maps, the west side of the city and more specifically the area near the Gare, the Saint Bruno neighborhood and the Eaux-Clares neighborhood, are the most affected by air pollution and lack of green public spaces. On the other hand, in the east and north side of the city where the natural element of the river Isère enables the creation of more green areas and less streets, the participants experience less air and noise pollution. An interesting observation is that the participants frequently visit the larger green public spaces while they don't visit the smaller or medium sized parks of their neighborhoods. The reason for this choice could be the proximity of each neighborhood to the parks but also the size or quality of these public spaces. The exclusion of smaller parks from the initial sensorial maps can be expressing the need for bigger green public spaces where there is a significant reduction of noise and air pollution.

In Figure 17, the participants' perception of high levels of air pollution and the green public spaces they most frequently visit are presented in the same map in order to highlight their spatial relation. It is evident that the most polluted areas are perceived to be located on the west side of the city. In the same areas, there is lack or absence of green public spaces. It is important to mention that air pollution is also connected to noise pollution as they have a common source which is road traffic.

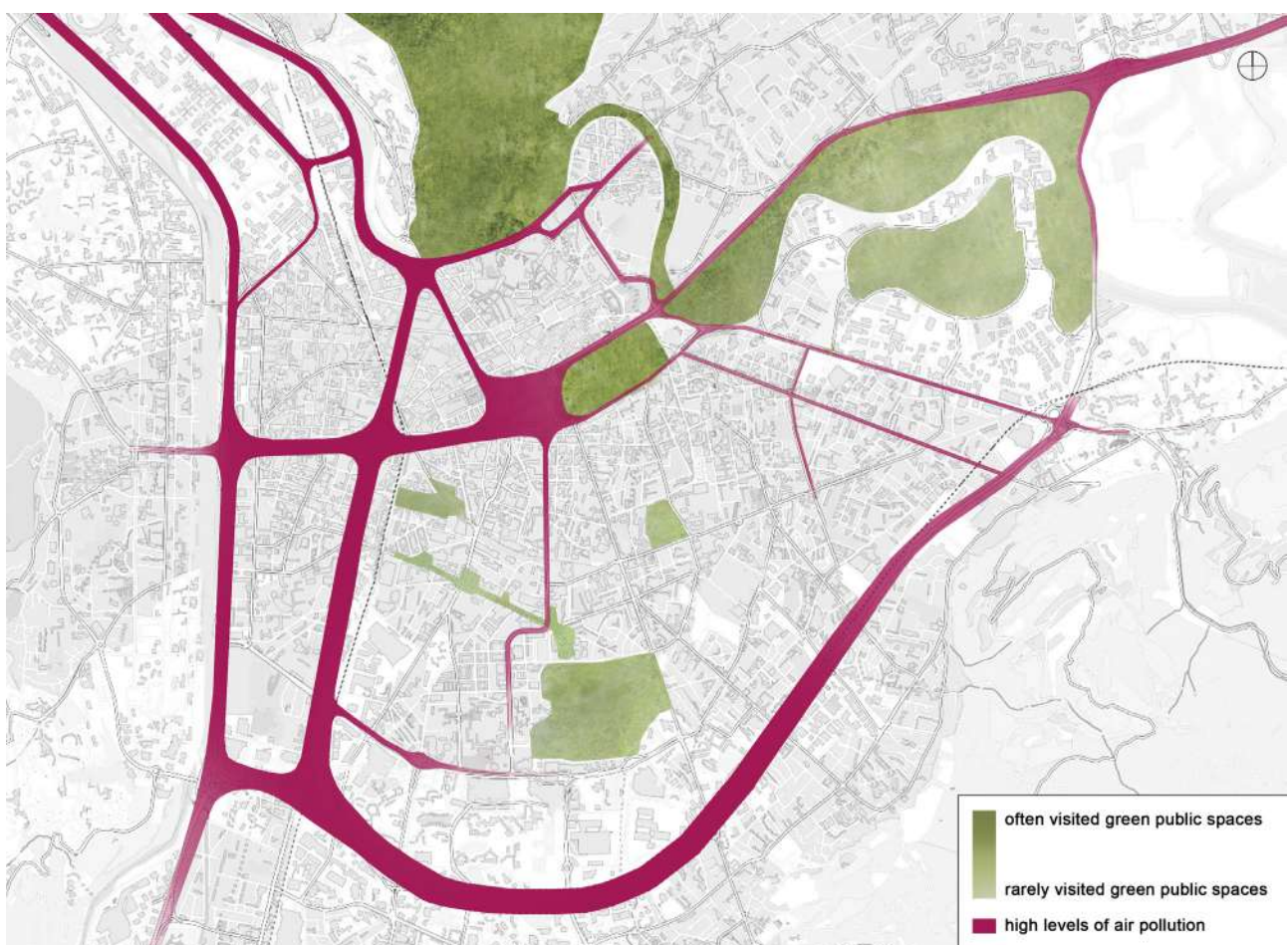


Figure 17. Map of air pollution and most frequently visited green public spaces

The less polluted areas and the most visited green public spaces are perceived to be located on the north-east side of the city, close to the Isère river.

Finally, a factor that affects the perception of pollution and the urban space is the background of each participant. Through both the interviews and the sensorial mapping, it is concluded that the participant's city or country of origin, the length of their stay in Grenoble, their age, habits and professional life lead to a lot of differences but also similarities in their experiences of pollution. For the participants that have lived in other countries, particularly in Southern Europe or in cities of the Global South, the levels of most types of pollution in Grenoble are considered to be low. Noise pollution and the littering in the public spaces of the city appear as an issue in the interviews and sensorial maps of the participants that have lived only in smaller cities or in rural areas of France. Secondly, the length of their stay in Grenoble also affects their perception of pollution. For example, the participants who live in Grenoble for more than five years appear to be more affected by air pollution. On the opposite, the participants who have spent less time in Grenoble, such as international students, support that they are not affected much by air pollution. Their movement in the city and their use of public space is affected by their length of stay in Grenoble as well as their professional life and daily habits. The participants who live in Grenoble for more than five years and have a stable professional life develop more specific routes in the city and choose to visit more frequently specific public spaces to avoid air and noise pollution. Additionally, most of them choose to visit the mountains around Grenoble on a weekly basis, in order to avoid the polluted urban space and be closer to nature. On the contrary, the participants who live in Grenoble for a short period of time have more diversity in the public spaces they visit and the way they move in the city as they choose longer paths to explore more neighborhoods.

Chapter 4: Conclusions

This master thesis focuses on how various types of pollution are affecting the inhabitants of different neighborhoods in Grenoble. Focusing on pollution, the methodological approach of the thesis consists of bibliographical research for the development of the theoretical part and on ethnographic research for the data collection. The data collection methodology is chosen based on the internship missions and on the theoretical analysis in Chapter 1. The data collection methodology includes in-depth interviews and sensorial mapping aiming to a participatory approach on the study and analysis of pollution in Grenoble. In the first part of the master thesis, through the bibliographical research on participatory urbanism and participatory research, it is concluded that participatory methodologies can be effective in urban practices and research.

A question that rises is whether this methodological approach is an effective tool for this master thesis and more specifically for the study of pollution in urban environments. Throughout the data collection process there were many challenges. First of all, engaging participants who live in different neighborhoods of the city proved to be challenging because the people involved had to devote time and energy in this project. In addition, most of the interviews and sensorial mapping exercises had to take place in the participants' apartments or houses in order to enable a discussion about toxicity and chemical products, related to the internship missions. Most of the potential participants were reluctant to give access in their private space. Regarding the sensorial mapping and the visual data analysis, the collective maps created with the overlapping of the participants' perceptions of pollution express a common experience but their different socio-demographic profiles are not represented. Finally, a limit of the research methodology is that the number of participants is very small as Grenoble has more than 450.000 inhabitants.

However, the implementation of this methodological approach had also many advantages and opportunities. The diversity of the participants and their active engagement to the interviews and the sensorial mapping provided with many different points of view and very useful information. The individual perspectives of the 16 participants were the basis of the data analysis which led to the exploration of the differences and similarities between their experience of pollution in Grenoble. The interviews enabled long and interesting discussions regarding how pollution affects their every day life in the city and their use of public space. These discussions were crucial for the development of the idea that pollution affects the way people perceive pollution in the urban space and the examination of the second hypothesis, which can become a subject for further research. Finally, the

sensorial mapping was a creative method for spatial data collection that allowed further graphic exploration and spatial analysis through the new maps.

The research question «Can sensorial mapping, as an initial participatory practice, become a tool for the analysis and reduction of pollution in cities?», is answered firstly in Chapter 1. From the bibliographical research it is concluded that the implementation of participatory methods in urbanism engages the inhabitants of cities in urban projects and can provide professionals and researchers with important knowledge (IAP2, 2020). Through participation, people are able to take responsibility for their own neighborhoods and get involved in the process of research and analysis of issues such as pollution in their cities. Secondly, the research question is answered through the analysis of the collected data in Chapter 3. The 16 participants showed interest in the subject of the research and were curious to explore the sensorial mapping technique. Their engagement in the interviews and sensorial mapping exercises, led to useful spatial information regarding their perception of pollution and how it affects their experience of the urban space and their life in the city.

From the analysis of the collected data, it is concluded that air and noise pollution affect in a great degree the way the participants move in the city. It also affects which public spaces they choose to visit and which areas they avoid. The new maps created from the analysis of the sensorial mapping highlight the areas in which the participants choose to go frequently because they are perceived as safer and less polluted. Even though there are multiple small parks in the city, the participants choose to visit specific, larger green public spaces where there is a perceptible reduction of air and noise pollution. Also, in the answers of the participants, there is a strong connection between lack of safety and high levels of air and noise pollution as well as between larger green public spaces and lower levels of air and noise pollution. In Figure 18, the city is presented fragmented in two sections regarding the levels of air and noise pollution and the availability of larger green public spaces. In this map there are two opposing elements: the highly polluted areas of the city (west-south) and the less polluted green public spaces (north-east). It is evident that even though Grenoble has multiple green public spaces which the participants choose to visit frequently, there is no balance in their spatial distribution. The neighborhoods that are perceived as the most polluted by the participants, do not have larger green spaces in proximity.

Regarding the reduction of pollution in cities, the analysis of the collected data does not provide with an answer or a proposal to the question. However, the aspect of participation opens a dialogue on the subject of pollution between the inhabitants. As pollution affects most of urban areas globally (Komberger and Borch, 2015) it can be stated that the inhabitants' perception of pollution can



Figure 18. The two sections of the city - high levels of air and noise pollution and green public spaces the participants frequently visit in order to avoid these types of pollution

become an effective tool to better understand the challenges that arise in highly polluted cities and the issues the people face on a daily basis related to pollution. Also, through participatory practices, the study of the perception of pollution can become an opportunity to share ideas, strengthen the sense of community and actively engage the inhabitants in research and action for the reduction of various types of pollution. With half of the global population living in urban areas (UN-Habitat, 2019), it is crucial that cities develop strategies for the reduction of pollution and towards sustainability. Citizen participation can be one of the tools towards urban sustainability (Teixeira et al., 2017) in order to create a safe and healthy environment for people and to reduce the negative impact that cities have on the natural environment.

The public spaces of cities, which according to the theoretical analysis in Chapter 1 constitute urban commons, are the physical space where discussion and collective action against pollution can be organized through the active participation of citizens (von Wirth and Rach 2019). From the different definitions of urban commons given in Chapter 1, it is concluded that in order for something to be an urban common it has to be a collective phenomenon in a specific space, something that is collectively perceived, utilized or dwelled (Kornberger and Borch, 2015). From the analysis of the

collected data it is concluded that the participants have a common perception of pollution in the urban space of Grenoble. The similarities in their perception of pollution and how it affects their use of public space and their movement in the city are mostly related to air and noise pollution. Most of their answers and visual representations of air and noise pollution, focus on the same areas and highlight similar issues. If different people from different neighborhoods have a common perception of pollution and the issues linked to it, could the perception of pollution be considered a collective phenomenon that also takes place in the public spaces of the city? And if this collective phenomenon is expressed and analysed through participatory practices where people interact and collaborate, could it be considered as a new urban common?

In an urban society, characterised by transformations (Lefebvre, 2003), urban movements are developed through spatial relations in the common urban public spaces (Castells, 1983). Participation in urbanism and research allows a more collective understanding of urban issues and a common use of the urban public space. Sensorial mapping as a participatory research tool for the analysis of pollution in contemporary cities, enables people to share their individual experience and highlights the common understanding of the issue. Taking into consideration the notion of urban commons, it can be stated that the individual perception of pollution is part of a collective experience that when shared and studied through participatory practices could be considered as a new urban common. Finally, considering the collective perception of pollution as a new urban common, participatory practices that take place in the urban realm, could possibly lead to transformations regarding pollution reduction in cities.

List of References

Books

1. Böhme, G. 2014 *Urban atmospheres: Charting new directions for architecture and urban planning*. in Borch, C. ed(s). *Architectural Atmospheres: On the Experience and Politics of Architecture*, Birkhäuser, Basel: 42-59
2. Castells, M. 1977 *The urban question: A marxist approach*. Translated by Alan Sheridan, Edward Arnold, London
3. Castells, M. 1983 *The City and the Grassroots*. University of California Press, Los Angeles
4. Creighton, J.L. 1994. *Involving citizens in community decision making: A guidebook*. Program for Community Problem Solving
5. Frantzeskaki, N. Castan Broto, V. Coenen, L. 2017 *Urban sustainability transitions: the dynamics and opportunities of sustainability transitions in cities*. *Urban Sustainability Transitions*. Routledge, New York: 23-42
6. Freire, P. 1970 *Pedagogy of the oppressed*. Seabury Press, New York
7. Gehl, J. 2010. *The lively, safe, sustainable and healthy city*. in Gehl, J. ed(s). *Cities for people*. Island Press, Washington: 63-115
8. Goel, P.K. 2006 *Water pollution: causes, effects and control*. New Age International, New Delh
9. Harvey, D. 2012 *Rebel Cities: From the Right to the City to the Urban Revolution*. Verso, New York
10. Kornberger, M. Borch, C. 2015 *Urban Commons Rethinking the City*. Routledge, New York
11. Lefebvre, H. 2003 *The Urban Revolution*. University of Minnesota Press, Minneapolis: 1-16
12. Maguire, P. 1987. *Doing participatory action research: A feminist approach*. University of Massachusetts Press, Massachusetts
13. Martínez-Bravo M., Martínez-del-Río J. 2019 *Urban Pollution and Emission Reduction*. In: Leal Filho W., Azul A., Brandli L., Özuyar P., Wall T. ed(s). *Sustainable Cities and Communities*. Encyclopedia of the UN Sustainable Development Goals. Springer, Cham
14. Nelson, N. Wright, S. 2001 *Power and Participatory Development Theory and Practice*, ITDG Publishing, London
15. Rekeawicz, P. 2021. *Radical Cartography*. in Schranz, C. ed(s). *Shifts in Mapping: Maps as a Tool of Knowledge*. transcript Verlag, Bielefeld: 209-232.
16. Rogers, D. 2020 *Understanding Urbanism*. in Rogers, D., Keane, A., Alizadeh, T., Nelson, J. (eds) *Understanding Urbanism*. Palgrave Macmillan, Singapore: 1-13

Journals

1. Aix, M. Petit, P. Biscout, D. 2022 *Air pollution and health impacts during the COVID-19 lockdowns in Grenoble, France*. *Environmental Pollution*. 303(7):119134.
2. Arnstein, S. R. 1969 *A ladder of citizen participation*. *Journal of the American Institute of planners*, 35(4), 216-224.

3. Attwood, H. 1997 An overview of issues around the use of participatory approaches by post-graduate students. IDS, *Participatory Research, IDS PRATopic Pack*.
4. Bhatnagar, B., & Williams A. C., 1992 Participatory Development and the World Bank. *World Bank Discussion Papers, 183, World Bank, Washington DC*
5. Borck, R. Schrauth, P. 2022 Urban Pollution: A Global Perspective. CESifo Working Paper, No. 10171
6. Liotta, Y. Kervinio, H. Levrel, L. Tardieu 2020 Planning for environmental justice - reducing well-being inequalities through *urban greening*. *Environ.* 112, 47-60.
7. Caneparo, L. Bonaverio, F. 2016 Neighborhood regeneration at the grassroots participation: Incubators' *co-creative process and system*. *International Journal of Architectural Research: ArchNet-IJAR*, (10). 204-218.
8. Dalton, C. Stallmann, T. 2018. Counter-mapping data science. *The Canadian Geographer*, 62(1): 93–101
9. Díaz, S. Fargione, J. Chapin, F. S. Tilman. D. 2006. *Biodiversity Loss Threatens Human Well-Being*. *PLoS Biology*, 4(8)
10. Feinberg, A., Ghorbani, A., Herder, P. 2021 Diversity and Challenges of the Urban Commons: A *Comprehensive Review*. *International Journal of the Commons*, 15(1), 1–20.
11. Grigoriadou, E. Bitsaki, M. Oungrinis, K. 2021 Analysing the potential of small-scale public spaces adjacent to primary schools of *Athens as drivers of more child-centred urban practices*. *International Journal of Educational Innovation*. 3(3), 100-110.
12. Harris, L. Hazen, H. 2005. The power of maps: (Counter) mapping for conservation. *ACME An International E-Journal for Critical Geographies*, 4(1): 99-130.
13. Istenič, S. 2019. Participatory Urbanism: Creative interventions for *sustainable development*. *Acta geographica Slovenica*, 59(1), 127–140.
14. Kidd, S. Kral, M. 2005 Practicing participatory action research, *Journal of counselling Psychology*, 52(2), 187-195
15. Kirabo Kacyira, A. 2012 Addressing the Sustainable Urbanization Challenge. *UN Chronicle*, 49(2), 58–60.
16. La Branche, S. 2016 Étude sociologique *sur la pollution due au chauffage au bois dans l'agglomération grenobloise : synthèse des principaux résultats*. *Pollution Atmosphérique : climat, santé, société*, 228, ff10.4267/pollution-atmospherique.5438ff. fffhal-01962391f
17. Largeron, Y. Staquet, C. 2016 Persistent inversion dynamics and wintertime PM10 air pollution in Alpine valleys. *Atmospheric Environment*. 135, 92-108.
18. MacDonald, C. 2012 Understanding Participatory Action Research: A Qualitative Research Methodology Option. *Canadian Journal of Action Research*, 13(2), 34-50.
19. Martos A, Pacheco-Torres R, Ordóñez J, Jadraque-Gago, E. 2016 Towards successful environmental performance of *sustainable cities: intervening sectors*. A review. *Renew Sust Energ Rev*. 57, 479–495
20. Maschke, C. 1999 Preventive medical limits for chronic traffic noise exposure. *Acousit*, 85, 448
21. McCormick, K. Anderberg, S. Coenen, L. Neij, L. 2013 *Advancing sustainable urban transformation*. *Journal of Cleaner Production*, 50, 1-11

22. Morelli, X. Rieux, C. Cyrus, J. Forsberg, B. Slama, R. 2016 Air pollution, *health and social deprivation*: A fine-scale risk assessment. *Environmental Research*. 147, 59-70.
23. Mueller, N. Rojas-Rueda, D. Khreis, H. Cirach, M. Andrés, D. Ballester, J. Bartoll, X. Daher, C. Deluca, A. Echave, C. Milà, C. Márquez, S. Palou, J. Pérez, K. Tonne, C. Stevenson, M. Rueda, S. Nieuwenhuijsen, M. 2020. Changing the urban design of cities for health: The superblock model. *Environment International*. 134. ISSN 0160-4120.
24. Ochocka, J., Moorlag, E., Janzen, R. 2010 A framework for entry: *PAR values and engagement strategies in community research*, *Gateways: International Journal of Community Research and Engagement*, 3, 1-19
25. Padilla, C. M. Kihal-Talantikite, W. Vieira, V. M. Rossello, P. Le Nir, G. Zmirou-Navier, D. Deguen, S. 2014 Air quality and social deprivation in four French metropolitan areas - A localized spatio-temporal environmental inequality analysis. *Environmental Research*. 134, 315-324.
26. Piracha, A. Chaudhary, M.T. 2022 Urban Air Pollution, Urban Heat Island and Human Health: A Review of the Literature. *Sustainability*, 14, 9234.
27. Sanoff, H. 2010 *Community participation in riverfront development*, *CoDesign* 1, 1, 61-78.
28. Sheppard, E., Gidwani, V., Goldman, M., Leitner, H., Roy, A., & Maringanti, A. 2015 Introduction: Urban revolutions in the age of global urbanism. *Urban Studies*, 52(11), 1947–1961.
29. Sherwood, J. Kendall, S. 2013 *Reframing spaces by building relationships: Community collaborative participatory action research with Aboriginal mothers in prison*, *Contemporary nurse*, 46(1), 83-94
30. Stavrides, S. 2022 Reclaiming public space as commons: learning from Latin American movements. *Revista INVI*. 37(106), 24-48.
31. Steffen, W. 2021 Introducing the Anthropocene: The Human Epoch, *Ambio*, 50 (10), 1784–87.
32. Steffen, W. Richardson, K. Rockström, J. Cornell, S.E. Fetzer, I. Bennett, E.M. Biggs, R. *et al.* 2015. *Planetary Boundaries: Guiding Human Development on a Changing Planet*. *Science*, 347(6223)
33. Stokal, M., Bai, Z., Franssen, W. et al. 2021 Urbanization: an increasing source of multiple pollutants *to rivers in the 21st century*. *Urban Sustain* 1, 24
34. Teixeira, S. Gardner. R. 2017 Youth-Led Participatory Photo *Mapping* to Understand Urban Environments. *Children and Youth Services Review*, 82, 246–53.
35. Wadsworth, Y. 1998 What is participatory *action research?*, *Action research international*, paper 2
36. Wuest, J. 1995 Breaking the barriers to nursing research. *The Canadian Nurse*, 91(4), 29-33.
37. Wulz, F. 1986. The concept of participation. *Design studies* 7(3), 153-162.
38. Zander, S.V. Figari, H. Kränge, O. Gundersen, V. 2023 Environmental justice in a very green city: Spatial inequality in exposure to urban nature, air pollution and heat in Oslo, Norway. *Science of The Total Environment*. 858(3), 160193.

Websites and articles

1. ATMO Auvergne Rhone Alpes. 2023 Bruit. <https://www.atmo-auvergnerhonealpes.fr/article/bruit> accessed 13/6/2023

2. Benfield, K. 2017 Sustainability and the Urban Commons. Smart Cities Dive. <https://www.smartcitiesdive.com/ex/sustainablecitiescollective/sustainability-and-urban-commons-part-1-2/164666/> accessed 4/4/2023
3. Comune di Bologna & Urban Center Bologna. 2014 Collaborare è Bologna. <http://www.comune.bologna.it/collaborarebologna/collaborare/> accessed 22/3/2023
4. European Commission. 2022 Grenoble starts as 2022 European Green Capital. <https://environment.ec.europa.eu/news/grenoble-starts-year-2022-new-european-green-capital-2022-01-14> accessed 14/6/2023
5. European Environment Agency. 2010 Sulphur dioxide (SO₂) emissions. <https://www.eea.europa.eu/data-andmaps/indicators/eea-32-sulphur-dioxide-so2-emissions-1>. accessed 12/4/2023
6. European Environment Agency. 2023 Pollution. <https://www.eea.europa.eu/en/topics/in-depth/pollution> accessed 12/6/2023
7. European Environment Agency 2022 Urban Air Quality. <https://www.eea.europa.eu/themes/air/urban-air-quality> accessed 12/6/2023
8. Florian, M. 2023. Copenhagen Architecture City Guide: 20 Projects to Discover in the 2023 UNESCO World Capital of Architecture. https://www.archdaily.com/146702/architecture-city-guide-copenhagen?ad_source=search&ad_medium=projects_tab&ad_source=search&ad_medium=search_result_all accessed 4/5/2023
9. GreenGrenoble2022. 2023. Why is Grenoble a Green Capital. <https://en.greengrenoble2022.eu/29-why-is-grenoble-a-green-capital.htm> accessed 14/6/2023
10. IAP2, 2023 IAP2 Core Values, <https://www.iap2.org/page/corevalues>, accessed 20/3/2023.
11. INSEE. (2023). Comparateur de territoires Commune de Grenoble (38185) <https://www.insee.fr/fr/statistiques/1405599?geo=COM-38185> accessed 13/6/2023
12. UN Habitat. 2018 SDG 11 Synthesis Report – Sustainable Cities and Communities. https://unhabitat.org/sites/default/files/2019/05/sdg_11_synthesis_report_web2_0.pdf. accessed 12/4/2023
13. Urbana. 2023. Inclusive Schoolyards at the 45th Primary School of Athens. <https://urbana.gr/en/portfolio/inclusive-schoolyards-at-the-45th-elementary-school-of-athens/> accessed 4/4/2023
14. von Wirth, T. Rach, S. 2019 Participatory design of people-centered cities: exploring a future research agenda. DRIFT working paper series <https://drift.eur.nl/projects/participatory-design-of-people-centered-cities/> accessed 15/3/2023
15. Wageningen University, 2022 ERC Advanced Grant for Embodied Ecologies. <https://www.wur.nl/en/newsarticle/erc-advanced-grant-for-embodied-ecologies.htm#:~:text=Embodied%20Ecologies%20is%20a%20groundbreaking,through%20collaborative%20and%20interdisciplinary%20research>. accessed 10/3/2023
16. Wallenfeldt, J. 2023 Grenoble France. <https://www.britannica.com/place/Grenoble> accessed 13/6/2023

Reports

1. UN-Habitat. 2019. *Sustainable urbanisation & sustainable development goals. United Nations Human Settlements Programme*
2. UN Habitat. 2001 Building bridges through participatory planning - Part 1 concepts and strategies. UN-Habitat
3. United Nations Environment Programme. 2017 *Towards a pollution-free planet background report*. United Nations Environment Programme, Nairobi

PhD Thesis

1. Duché. S. 2013. *La pollution de l'air en région parisienne : exposition et perception sur les sites touristiques*, Géographie, Université Paris-Diderot - Paris VII, Paris. 11-15

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Figure 1: Visit Copenhagen. 2023 How Copenhagen is pioneering in sustainable urban development. <https://www.visitcopenhagen.com/copenhagen/neighbourhoods/sustainable-urban-development> accessed 25/4/2023

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Figure 3: Castrezzati, M. 2023. Barcelona's Superblocks: Putting People at the Center - Literally. <https://citychangers.org/barcelona-superblocks/> accessed 10/8/2023

Figure 4: Green Grenoble 2022. 2022 Why is Grenoble a green capital? <https://en.greengrenoble2022.eu/29-why-is-grenoble-a-green-capital.htm> accessed 28/4/2023

Figure 5: ATMO Auvergne-Rhone-Alpes. Carte stratégique Air 2015-2019. <https://atmoaura.maps.arcgis.com/apps/webappviewer/index.html?id=aebd9f8426c24193b95f86d92ab33dcd> accessed 25/4/2023

Figure 6: Orphane. <http://www.orhane.fr/> accessed 25/4/2023

Figure 7: ATMO Auvergne-Rhone-Alpes. CARTES ANNUELLES de la qualité de l'air en 2022 <https://atmoaura.maps.arcgis.com/apps/instant/portfolio/index.html?appid=237ff00e7312441699cebb137ffc40a4> accessed 25/4/2023

Figure 8: Orphane. <http://www.orhane.fr/> accessed 25/4/2023

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Diagram 1: Feinberg, A., Ghorbani, A., & Herder, P. 2021 Diversity and Challenges of the Urban Commons: A Comprehensive Review. *International Journal of the Commons*, 15(1), 1–20.

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Diagram 4: created by author

Diagram 5: created by author

Appendix

Interview guide for the Embodied Ecologies programme in Grenoble

The 16 participants of this research are inhabitants of Grenoble who live in different neighborhoods of the city. As shown in Diagram 4, the participants were diverse in gender, age, length of stay in Grenoble, country or city of origin and occupation. The areas of the city where the participants live are: Villeneuve, Gare area, Saint Bruno, Championnet, Île-Verte, Teisseire, Eybens, Eaux-Claires, Saint Martin D'Hères and Exposition-Bajatiere.

Questionnaire

- Quel est ton/votre prenom ? Quel âge as-tu/avez-vous ?
- Avez-vous une famille ? Combien d'enfants avez-vous ?
- Où êtes-vous né ? Où avez-vous grandi ? Où avez-vous étudié ?
- Quelle est votre profession ? Quel est votre travail actuel ?
- Depuis combien de temps êtes-vous à Grenoble ?
- Dans quels quartier-s avez-vous habité à Grenoble ?
- Avez-vous habité dans autres régions du France ? À l'étranger ? Pour combien de temps ?
- Où voulez-vous vivre et travailler dans le futur ?
- Où allez-vous fréquemment dans la ville ? Quelles parties de la ville évitez-vous ? Pourquoi ?
- Pourquoi aimez/n'aimez-vous pas cet endroit ? Comment vous sentez-vous quand vous etes là-bas ?
- Pourriez-vous décrire l'endroit: beau, calme, bruyant, sûr, vivant...?

Pollution de l'eau:

- Comment est l'eau ici ? Est-ce que vous en buvez ?
- D'où vient l'eau ici ?
- Vous l'utilisez pour laver, cuisiner ou arroser vos plantes ?
- Y a-t-il des inondations ?
- Il y a une saison sèche à Grenoble ? Il pleut souvent ?
- Il y a des périodes où il n'y a pas d'eau ou l'eau n'est pas propre ?
- Quels effets cela a-t-il sur vous ? Cela affecte-t-il votre santé ?
- Selon vous, qui d'autre est concerné par cette situation ?
- Quelles sont les options si vous voulez boire de l'eau plus propre ? Combien ça coûtera ?
- Il y a des endroits où l'eau est meilleure qu'ici ? Pourquoi ?
- L'eau est meilleure aujourd'hui qu'avant ?

Pollution de l'air:

- Comment est l'air ici à Grenoble ? C'est comment dans ton quartier ?
- En quelle saison la qualité de l'air est meilleure ? Pourquoi ?
- Quand est-ce que l'air est mauvais ici ? Pourquoi ?
- Quels effets cela a-t-il sur vous ? Cela affecte votre santé ?
- Affecte-t-il d'autres personnes comme les enfants ou les personnes âgées ?
- Que faites-vous pour éviter la pollution de l'air ?
- Faites-vous quelque chose pour réduire la pollution de l'air ?

Pollution du sol:

- Généralement, il y a des plantes à Grenoble et dans quel état sont ces plantes ?
- Et dans votre quartier ? Est-ce-qu'il y a un endroit vraiment verte ? Noter sur le plan
- Est-il possible de planter à quelque part dans la ville ? Savez-vous où ? Noter sur le plan
- Utilisez-vous ces espaces pour planter ?
- Mangez-vous des légumes plantés en ville ?
- Vous connaissez si le sol est-il fertile à Grenoble ? Est-ce que les gens utilisent quelque chose pour rendre le sol plus fertile ?
- Les pesticides sont-ils souvent utilisés ici ?
- Quelles sont vos options si vous voulez avoir de meilleures légumes ou plantes ?

Pollution sonore:

- Que pensez-vous du bruit de Grenoble ?
- Est-ce souvent calme dans votre quartier ? Comment cela vous fait sentir ?
- Êtes-vous impacté par le bruit dans votre quartier tous les jours ? Savez-vous quelle est la source principale ? Où est-elle ? Noter sur le plan
- Où sont les endroits calmes dans la ville ? Choisissez-vous d'y aller souvent ? Noter sur le plan

Gestion des déchets:

- Que pensez-vous de la propreté de la ville ?
- Où sont les espaces le plus propres / les plus sales ? Noter sur le plan
- Où sont les poubelles dans votre quartier ? À quelle fréquence sont-ils ramassés ? Le payez-vous ?
- Existe-t-il différents types de poubelles (compostage, recyclage) ? Utilisez-vous ces poubelles ?

Questions générales:

- Lesquelles des éléments d'eau, de l'air, du sol est selon vous les plus polluée à Grenoble ?
- Où dans la ville vous sentez le plus cette-s pollution-s ? Où dans votre quartier ? Noter sur les plans

- Comment cela affecte-t-il votre vie et votre santé ?
- Selon vous, quelle est le type de pollution le plus sensible a Grenoble ? Quelle est la source de ce type de pollution ? Et dans votre quartier ? Où est-elle ? Noter sur les deux plans
- Comment vous sentez-vous pour ca ? Pouvez-vous choisir une couleur pour dessiner ce sentiment sur le plan ?
- Faites-vous quelque chose pour éviter cette pollution ? Pour la réduire ?
- Habitant ce quartier, avez-vous des symptômes négatifs comme des maux de tête, de la fatigue ou des allergies ? Où dans votre quartier est-il plus possible de sentir ces symptômes ? Noter sur le plan
- Que faites-vous pour éviter ces symptômes ?
- Ily y a des moments pendant l'année où la pollution dont vous parlez devient un problème plus important pour vous ? Où est-elle plus forte ? Noter sur les plans
- Pensez-vous que l'environnement est plus propre ces dernières années que dans le passé ou plus pollué et toxique ? Pourquoi ?
- Que changeriez-vous à l'endroit où vous vivez actuellement ?
- Quel serait votre endroit de rêve pour vivre? Quel type de maison ? Quel type de communauté serait bon pour vous et votre famille ? Quelles sont les caractéristiques de cette communauté ?