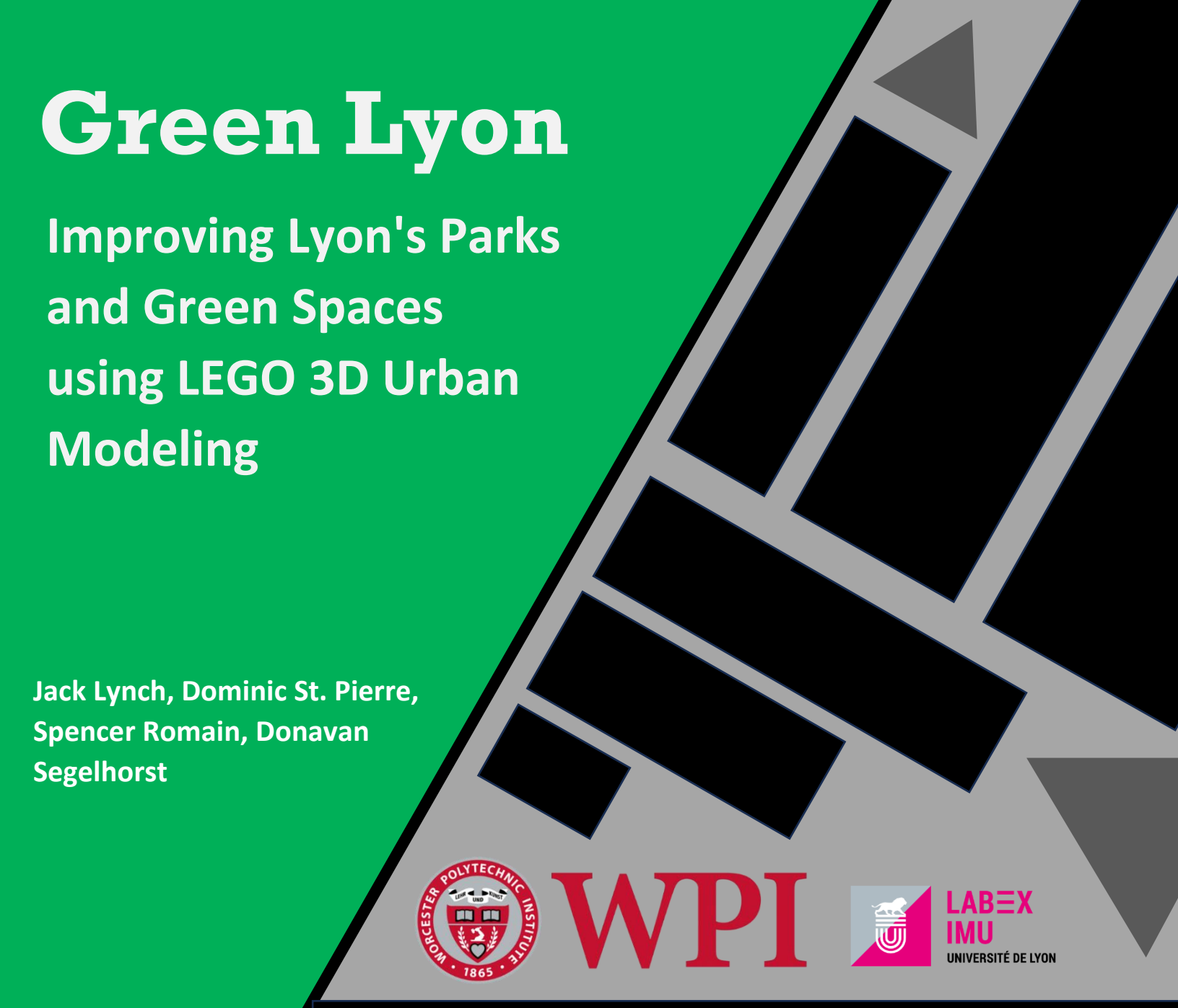
Green Lyon

Improving Lyon's Parks and Green Spaces using LEGO 3D Urban Modeling

Jack Lynch, Dominic St. Pierre, Spencer Romain, Donavan Segelhorst



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LABEX IMU
UNIVERSITÉ DE LYON

Green Lyon: Improving Lyon's Parks and Green Spaces using LEGO 3D Urban Modeling

An Interactive Qualifying Project submitted to the faculty of Worcester Polytechnic Institute in partial fulfillment of the requirements for the Degree of Bachelor of Science

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Abstract

Innovative urban planning methods for sustainable cities are crucial as they continue to grow. The University of Lyon's LabEx IMU aims to improve urban sustainability and address urban concerns in Lyon, France using a 3D LEGO scale model, where they desired improvements on its effectiveness and new use cases. Our team proposed improvements to the model with the focus on improving and further implementing green spaces in Lyon. Recommendations included incorporating new projections and model features that portray the lack of green spaces and their effects on urban systems in an increasingly comprehensive and interactive manner. These recommendations will further engage and educate users on the importance of urban green spaces, building a collaborative environment for conversations on potential solutions, subsequently improving the quality of life in Lyon.

Acknowledgements

We would like to thank our partners at LabEx IMU: Gilles Gesquière, Corentin Gautier, and Johanna Delanoy for their guidance, feedback, and cooperation during the Beyond LEGOs project. We also thank our advisors Curtis Abel and Farley Chery for advising our project, Fabienne Miller for organizing the amenities needed for us to have the opportunity to work in Lyon, and Courtney Kurlanska for providing insight and feedback for our project proposal.

The Beyond LEGOs team would also like to thank the many citizens of Lyon who participated in our surveys and mapping exercises and the team at MIT Media Lab who provided insight on their many urban modeling projects. We would like to specifically thank Dr. Luis Alonso Pastor for an interview with the Beyond LEGOs team. Their collaboration with the Beyond LEGOs project has greatly aided in our research objectives and our recommendations to the LabEx IMU team.

Executive Summary

Background

Cities have been an important aspect of humanity since the dawn of civilization, and with the ever-increasing population of the world, they are growing to be bigger and more populated than ever before. Due to this, city planners must continuously find new ways to ensure a positive quality of life in cities as populations continue to change. As cities grow, so do the problems associated with them, such as increasing pollution, health problems, and ambient temperature. A solution that addresses such challenges are green spaces. Green spaces absorb much of the pollution that comes out of cities, such as air and noise pollution, along with reducing ambient heat, improving the overall health of urban residents. A way that city planners can plan out such developments is with urban modelling. This provides a way for both researchers and stakeholders to gain a better understanding of the city by portraying the data in a more comprehensive way, creating collaborative environments for conversations on solutions to said urban issues. Models can include both physical and digital components, which can be projected on to the model. They can also be made out of a wide range of materials. One of these materials is LEGO, where the University of Lyon's LabEx IMU is using the popular toy bricks in modeling urban issues in the Gratte-Ciel district of Villeurbanne, a part of Lyon, France. Their goal is to use their model to inform audiences on urban issues in a more comprehensive and engaging way, where they have asked the Beyond LEGOs team to recommend improvements on the model's effectiveness and to recommend new use cases. The Beyond LEGOs team decided to recommend improvements on the model's effectiveness using green spaces as a use case.

Methods

Three objectives were established to make recommendations to LabEx IMU on their model, with those being to determine the perspectives and priorities for urban development in Lyon's parks and

green spaces, to understand community interaction with green spaces in Lyon, and to evaluate the successes and challenges of the LabEx IMU model, along with those of other modeling projects. The first objective was achieved by distributing a survey to gather information about the people's opinions on green spaces. The second objective was achieved by performing a mapping activity in the district of Gratte-Ciel to see how prominent people consider green spaces to be in the district. The third objective was achieved by interviewing LabEx IMU model creators to learn more about their modeling efforts. Interviews were also held with MIT's Media Lab, having made similar LEGO urban models, to learn of potential features LabEx IMU could use to improve their model.

Findings

From our surveys we discovered that the people of Lyon care about green spaces and consider them important in choosing where to reside and work. We also managed to get some insight into areas where there are not many green spaces, with the most common answer being Villeurbanne, which includes Gratte-Ciel. From the mapping we discovered that greenery is not prevalent In Gratte-Ciel, despite there being several parks, where only one person mentioned a park and only five people mentioned any other greenery. This shows that green space developments are not in optimal locations to be properly used by the public. From our interviews we gained more insight on the strengths and weaknesses of LabEx IMU's and MIT Media Lab's current models. The strengths of the LabEx IMU model came with its' usability and engaging features. Its' high usability was directly related to its' use of LEGOs, where the model is incredibly reproducible, replaceable, mobile, and cost and time efficient. Its' engaging features were also directly related to the use of LEGOs, where the use of LEGOs captivated the attention of diverse audiences. This also came with the model's dynamic visuals and audio through personable narratives made by the LabEx IMU team. However, no model is perfect. They want to improve its construction process, appearance, projection methods, along with a strong desire for more interactive features as to increase stakeholder participation in the model. Through interviews with MIT Media Lab, we learned the successes their model's interactive features had on model participation, where interactive tools such as: augmented reality, predictive algorithms, and movable model components whos' placement updates the digital projections have proven to be effective tools in engaging audiences and increasing participation on the models. However, these features come with difficulties as implementing such adds further complexity to the model, potentially compromising its efficiency.

Recommendations and Conclusions

From this data, it can be concluded that green spaces are very important to Lyonnaise citizens and that increasing green space development would be a welcome change, especially in Gratte-Ciel. To improve and further implement parks and green spaces in Lyon, three recommendations were made to LabEx IMU in the form of three new use cases. First was to create further narratives on the model, providing stories on how individuals are affected by current green spaces using results from the survey and mapping. This will allow an engaging personable and relatable connection to the model. This can be done in tandem with the second recommendation, which is to incorporate more projections showing the direct link green spaces have with other urban issues, such as air and noise pollution and urban heat islands. This will provide the data to back the words of Lyonnaise citizens, making it easier to

comprehend such urban issues and their connection to green spaces and the health of urban communities. Lastly, through incorporating interactive features, the model will further increase participation and comprehension on urban issues and their effects while creating a collaborative environment for conversations on potential solutions. With these recommendations, the model will allow for urban planners to allocate resources through using evidence-based decision making when choosing potential green space development projects.

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Introduction

Cities have been a staple of human civilization and are growing faster than ever before. The United Nations predicts that by 2050, 66% of the world's population will inhabit cities (United Nations, 2018). This is because of the numerous benefits urban areas offer relating to human health and wellbeing, from convenient access to healthcare and recreational opportunities, to diverse social networks and cultural experiences. However, rapid urbanization has caused some adverse effects that must be addressed, such as air and water pollution and urban heat islands. According to estimates, cities currently produce 75% of all pollution; and given the urbanization trend, this percentage is predicted to rise (United Nations, 2019). Additionally, across 93 European cities, heat islands cause about 6,700 premature deaths each year (Iungman et al., 2023).

Despite these issues, cities can promote sustainability. By concentrating populations in high density areas, cities can reduce energy consumption and air pollution emissions. This has been achieved by building energy efficient buildings and public transportation, green spaces and vegetation, and the use of renewable energy sources (Day, 2016).

A way to advocate for such sustainability efforts is through urban modeling. From two-dimensional (2D) imagery to physical three-dimensional (3D) interactive urban modeling, issues can be displayed in a clear and comprehensive way allowing easier discussion and testing on sustainability solutions. The University of Lyon's Laboratoire d'Excellence: Intelligences des Mondes Urbains (LabEx IMU) is doing exactly that. Their interactive 3D LEGO model showcases areas of Lyon with urban concerns such as vegetation, mobility, and noise pollution using a LEGO mockup and projector. With these projections, they aim to start conversations on solutions to said urban concerns.

This project addresses urban green spaces and collaborates with LabEx IMU in improving their urban model and working in implementing new green spaces. The effects green spaces have on those in Lyon is explored through surveys and mapping. Then with their responses and interviews with model creators from LabEx IMU and other urban modeling projects, improvements are suggested to LabEx IMU regarding the current model's interactive features and future projections. With improvements to LabEx IMU's model, in promoting and proposing new urban green space and vegetation developments in Lyon, the quality of life in the city will improve. In the following sections, you will learn about the physical and mental impacts green spaces have on city inhabitants, how they help address urban concerns, and how urban design can make this possible.

Background

Now more than ever we are living in a rapidly changing world that is becoming more technologically advanced. The question that arises now is how we can use this new technology and ways of thinking to change and adapt our built environment to reflect this push towards a smarter future. This can be done by improving the way we plan our cities through utilizing new tools to map and critically analyze the spaces we inhabit. Through multiple methods, it is possible to adjust our living and working environments to reflect our inner and community goals to better match the needs of humanity.

Quality of Life and Urban Design

The design and planning of our cities play a major role in not only how city inhabitants live their lives but greatly affects their well-being and overall satisfaction. As urban spaces are growing and as more people move into cities around the world, analyzing the design of key infrastructure is crucial in understanding how we interact with the built environment. There are multiple pathways in which this interaction is explored, which include travel, leisure, work, social relationships, residential well-being, emotional responses, and health. Life satisfaction, emotional wellbeing, and eudaimonia (Greek for 'good spirit' or 'happiness') are three categories of subjective well-being that are affected by these pathways (Mouratidis, 2021). Access to natural spaces, such as parks and green spaces, can promote emotional wellbeing by reducing stress and improving mood. Transportation systems, such as public transit or bike lanes, can improve life satisfaction by providing easy access to amenities and reducing commuting time. Building strategies, such as incorporating natural light and ventilation, can enhance eudaimonia by promoting a sense of connection to nature and sense of purpose. Through understanding the pathways between the built environment and subjective well-being, we can work towards creating healthier, more livable communities that promote improved overall wellbeing.

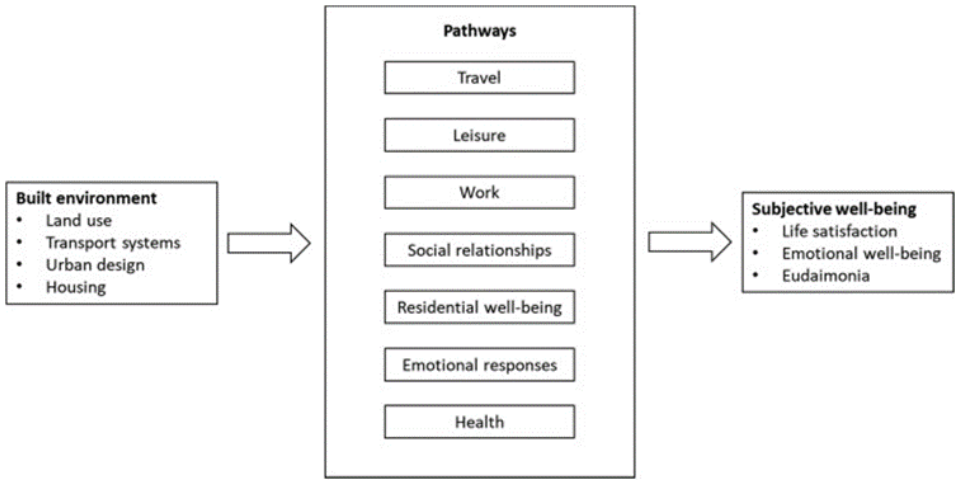

Figure 1: Model of Pathways Linking the Built Enviroment to Subjective Well-Being (Mouratidis, 2021)

Neighborhood satisfaction measures how well the designated sector of a city satisfies the needs of individuals and households and the level to which these needs are fulfilled in the eyes of the residents. The main factors that affect satisfaction are the location of the neighborhood in relation to the larger city environment alongside the existence and convenience of local amenities and usable green spaces. It is also necessary to have equitable access to beneficial amenities to provide healthy options for food and health care facilities as these aspects greatly contribute to our subjective wellbeing (Mouratidis, 2021). The more ways that the built environment adds to our daily lives in a meaningful and more equitable manner, the greater chance it gives to improve overall city satisfaction and happiness, as well as on a national scale.

There are a few common trends and strategies that can advance the subjective well-being of residents in urban areas. These include an increase in natural spaces, public and communal spaces, facilitating active travel options such as walking and biking, investing in better public transport, introduction of technology, new mobility options, and increase of natural spaces all lead to benefits in well-being (Mouratidis, 2021). These strategies can be implemented in multiple ways, such as through public works projects or private enterprises. By having public and private stakeholders work together to address these issues it is possible to greater improve these pathways by increasing factors such as providing new and diverse spaces, affordable housing, and improving pedestrian and local circulation paths (Southworth, 1989). Yet these changes do not happen overnight as urban planning is a long-term endeavor, as construction projects and the erection of buildings and spaces tend to take many years to complete. Therefore, careful consideration must be given in the early stages to plan out effective means of shaping the city fabric. Many cities tend to favor good urban design to increase economic benefits and increase economic development by improving its image and workability so that people will want to move in and invest (Southworth, 1989).

It is also important when looking at urban design today to consider other major factors such as climate change. Reducing carbon emissions is a key step in alleviating the burden that our modern cities cause on our climate as they are responsible for around 80% of greenhouse gas emissions in the world. Tactical urban planning can lighten the effects of other issues such as heat islands by designing more green spaces to add more natural shading and increase carbon storage. By adding around 10% more tree canopy cover, it was concluded that it could reduce surface temperatures by 15% in Australian cities (Heymans et al. 2019). Such methods can be implemented in any city across the globe and have multiple benefits to both the environment and human wellbeing.

Urban Challenges & Their Effects

Urban areas face a range of challenges that impact the well-being of residents and the sustainability of the cities themselves. Environmental challenges, including heat islands, air and water pollution, and climate change, have significant consequences for human health and quality of life. Heat islands are urban areas that experience higher temperatures than surrounding rural areas due to the increased concentration of buildings, roads, and other human-made surfaces that absorb and retain heat. This can lead to a range of negative impacts, such as increased energy consumption for cooling,

reduced air quality, and negative health effects for residents. Hwang et al. (2009) reported that an urban heat island intensity level between 1.9°C and 3.2°C caused Taiwan to experience an increase in household yearly cooling energy from 1979 to 2003 of 87.3% to 243.6%.

Air and water pollution are also significant challenges for urban areas, with potential health impacts for residents. It has been found that urban areas in the United States experienced higher levels of air pollution compared to rural areas, with a higher percentage of residents living in areas that did not meet national air quality standards (Strosnider et al., 2017). In addition, water quality can also be impacted by urbanization, with potential contaminants from sources such as stormwater runoff and industrial activity. This highlights the need for effective urban planning and policies to mitigate the negative impacts of urbanization on the environment and public health.

Climate change poses significant challenges for urban areas, with consequences such as increased frequency and severity of extreme weather events, flooding, and water scarcity (Reckien et al., 2014). To address these challenges, cities around the world are implementing various strategies and policies, such as stormwater management and urban heat island mitigation (Roberts et al., 2016; Battista et al., 2023). However, these efforts often face significant obstacles, such as lack of funding and political will.

Urban areas also face significant health challenges, including mental health issues and unequal access to healthcare services (Patel et al., 2018). In addition, the lack of access to green spaces and recreational areas can lead to physical inactivity and obesity (Kabisch et al., 2015). Furthermore, there is a growing recognition that urban areas suffer from a lack of equality, with marginalized communities often experiencing higher levels of poverty, unemployment, and crime (Strosnider et al., 2017). In addition, Letnik et al. (2018) found that urban transportation is a major contributor to air pollution, which can lead to respiratory problems, cardiovascular disease, and other health issues.

These challenges are exacerbated by the deterioration of infrastructure in many urban areas, which can lead to issues such as water and electricity shortages, traffic congestion, and poor waste management (Albuquerque et al., 2021). Urban areas face a range of challenges that require coordinated efforts from government, community organizations, and individuals. Addressing these challenges will require innovative solutions and a commitment to sustainability and equity.

Addressing Urban Challenges

Green Spaces and the Climate

With the many problems that urban environments face, from air pollution to public health, one may wonder what a city planner can do to remedy these issues. One solution to these problems is green spaces. Urban Green Spaces, or UGSs, refer to places such as parks with a lot of vegetation found within a city. These spaces may not seem like a big deal when compared to other solutions to urban challenges, like smart cities, but green spaces are relatively easy to implement and provide a massive benefit. One

study conducted in 2010 found that larger UGSs can lower the temperature of an area by .94 °C (Bowler et al., 2010). A more recent study determined that even smaller green spaces with dense vegetation can reduce the temperature by 1-3 °C (Grilo et al., 2020). This is all without even mentioning the impact UGSs have on the citizens living in the city. Green spaces are incredibly efficient at lowering temperatures and providing a fix to the heat island problem, as well as other problems.

As previously mentioned, UGSs have a significant impact on the temperature of the area. This cooling effect is not just exclusive to the space itself, as its cooling effects have been shown to extend over 350 m (about 1148.29 ft) outside the park (Aram et al., 2019). One study conducted in Lisbon, Portugal, analyzed the effects that green spaces had on the temperature. They analyzed two parks which were adjacent to a city square, from their sensors the study was able to determine that areas closer to the park tended to be cooler than areas that were farther away. Similarly, the areas closest to the park tended to have increased humidity compared to areas farther away (Grilo et al., 2020). The decreasing of the temperature plus the increasing of the humidity that the parks provide aid in countering the heat island effect, so much so that some studies, such as this one, refer to UGSs as urban cool islands, signifying the impact they have at reducing the impact of heat islands.

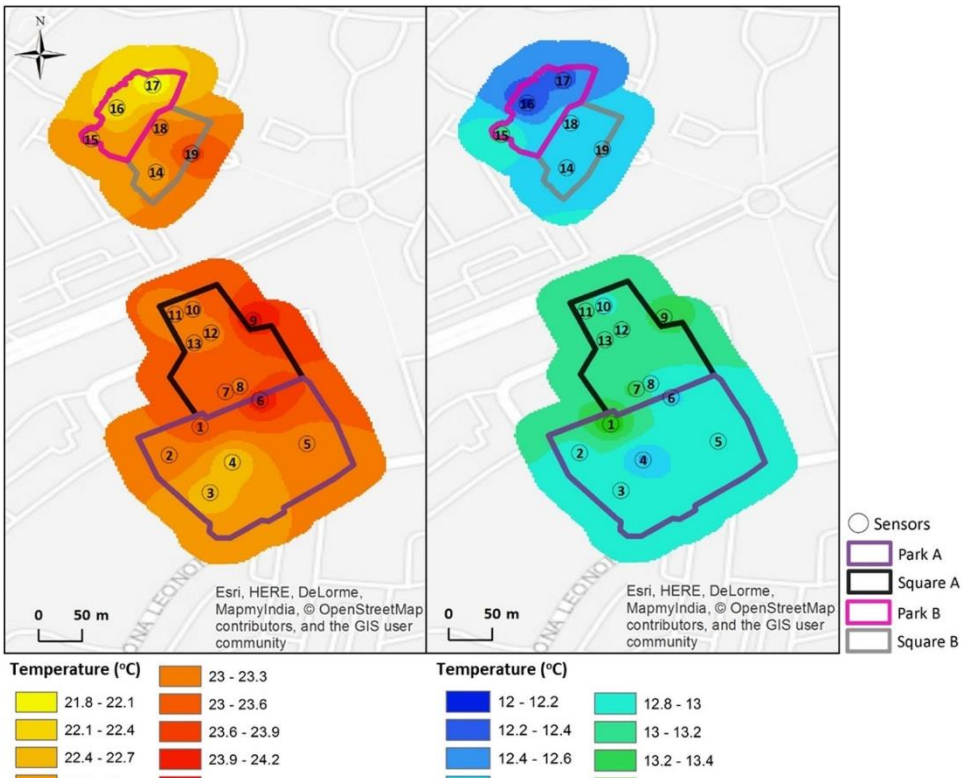

Figure 2: Temperature Map on the Effects of Green Spaces Have on Urban Heat Islands (Grilo et al., 2020)

Green Spaces and the People

It has been shown that green spaces help impact the environment, but it is also important to look at how green spaces impact the people in cities. When looking at the evidence, UGSs are shown to have a positive impact on the well-being of the people. For example, social isolation is a major problem in the current world, especially after the recent COVID-19 pandemic. Studies indicate that having green spaces and vegetation in a city reduces the loneliness of the population (Astell-Burt et al., 2022). Another study concluded that UGSs lead to an increase in cognitive abilities, such as memory, in young children when compared to children who are in areas without UGSs (Dadvand et al., 2015). Green spaces have also been shown to be a way to alleviate mental health conditions such as depression. A study conducted on people with mental illnesses like depression found that exercising in green spaces significantly increased the participants' self-esteem and mood (Barton et al., 2012). A similar study determined that simply being exposed to green spaces can improve mood and well-being (Carrus et al., 2015). Green spaces, and being in nature in general, can have a significant impact on one's mental health, and in a post COVID world where mental health issues abound, anything that improves mental health is a net positive.

Besides mental health, green spaces are also a boon to people's physical health as well. For instance, a study conducted on Montreal, Canada found that men who lived near green areas were at lower risk of prostate cancer when compared to men who do not live near green spaces, which is largely thanks to UGSs' ability to reduce cancer causing pollution (Demoury et al., 2017). Parks are also a good place for children in urban environments to play, which allows kids to enjoy nature and the outdoors when they may not otherwise have the chance to in a city. This physical activity can help keep children active and healthy. In a study conducted by Wolch et al., it was proven that children with more access to parks and recreational resources were less likely to experience significant increases in attained BMI (Wolch et al., 2011). The impact that green spaces have on the overall health of the populace should not be overlooked.

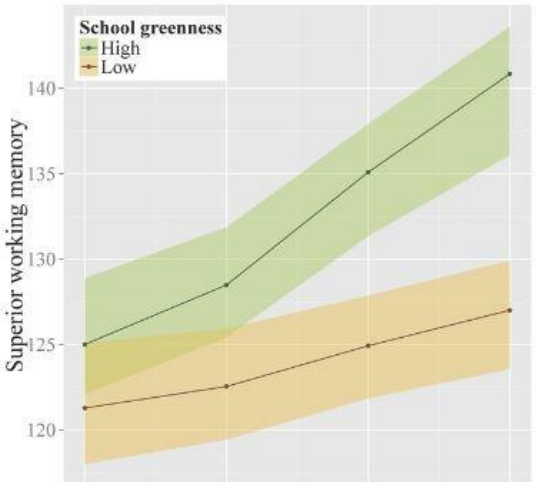

Figure 3: Correlation of Childrens' Memory with Green Space Availability (Dadvand et al., 2015)

Green spaces are an incredible tool for increasing the quality of life in cities. The increase in vegetation within the city helps reduce the temperature of the park and nearby areas. The temperature reduction is beneficial in reducing the negative effects of heat islands on the city populace. The green spaces also impact people's mental and physical well-being, as it has been proven that exposure to green spaces leads to an increase in cognitive abilities and mood. They also reduce health risks such as cancer. Similarly, there has been a reduction in overall mortality due to the lack of pollution, as the decreased pollution led to a decrease in respiratory diseases (Villeneuve et al., 2012). Not to mention, green spaces also provide an easy and accessible way to go out and exercise, which also helps increase

the overall health of the populace. With all the problems which cities face, green spaces offer a solution which provides a plethora of benefits.

Modern Urban Modeling

As new ideas for city planning become increasingly important, new methods are being created to help implement these ideas. Common methods that have been used involve both digital and physical urban modeling.

A common digital approach is 2D renderings. This simplistic, easily visualized, and popular approach was done in San Antonio, Texas. Due to rapid deforestation caused by increased urban development, satellite imagery was rendered in image processing software to reveal areas in the city where more trees could be planted (Harte, 2003). However, such models have limited representational accuracy through the absence of the vertical dimension, potentially reducing its' comprehensiveness and effecting decision making.

Three-dimensional models incorporate those lost elements of 2D renderings, most notably digital twins. These models allow for a fluid digital model of urban environments. As digital twins and many other digitalized urban development models are updated constantly, it is an incredibly fast and beneficial way for urban planners to see how potential urban developments may play out before investing resources to carry out such plans (Deprêtre, A et al., 2022). Take Helsinki, Finland for example. With urgent advances to implement clean energy and reduce carbon emissions in cities, solar panels have been a popular solution. However, they have their limitations as factors such as orientation and shading drastically affect their effectiveness. The city of Helsinki addressed this using digital modeling processing, where an aircraft scanned the city to create a 3D digital twin model of the city. The model was then used to find suitable areas in the city where there was minimal shading, providing ample locations for solar panels (Murray, 2022).

Although digital models are becoming more widely used due to advancements in data collection methods and 3D rendering software, physical models are still used and often preferred over other methods. As seen in London, England, a 1:10 scale model of a residential area was constructed to measure how materials used in their construction affect the local albedo, the fraction of light that surfaces reflect which influences urban ambient temperature. With data collected from the physical model, they can see which materials used in the residential area contribute to raising the albedo and propose the use of alternative materials to reduce urban ambient temperatures (Kotopouleas et al., 2021).

Even smaller physical models can be used, including those that are 3D printed. In Dwarka, a sub city of Delhi, India, 3D modeling was used to combat rapid population growth in the area (Ellul et al., 2013). The 3D model provided urban developers, contractors, and government officials with a clear interactive visual on the current layout, where they could brainstorm possible urban developments to

maintain the area as the population grows. Although digital rendering offers more features, physical models can be more coherent and provide better visualization and capability.

Many projects have incorporated aspects of both digital and physical modeling. Massachusetts Institute of Technology's Media Lab CityScope Champs- Élysées project is doing exactly that. This project displays a 3D model of Paris' Champs- Élysées in France and the surrounding area within a dynamic projection to display urban mobility around the famous monument. This research is intended to improve decision making and to revitalize the Champs- Élysées through improving mobility and incorporating nature around the avenue along with creating new public spaces in the city (Grignard et al., 2020). When using both digital and physical modeling, the urban model can display the best of both modeling techniques with visually compelling, comprehensive, live data displayed on a physical 3D environment with the same qualities.

Another case study done by the MIT Media Lab is their interactive 3D LEGO model of Kendall Square in Cambridge, Massachusetts, United States. This area has undergone vast development due to the growing biotech industry and local universities, such as MIT and Harvard. Limited housing and zoning ordinances have made living near Kendall Square expensive, forcing many who work there to commute. Additionally, amenities such as coffee shops and restaurants are scarce in the area. It is with this that the MIT Media Lab developed CityScope Volpe, an interactive physical 3D LEGO model built to investigate the redevelopment of a 14-acre facility purchased by MIT. The model uses interchangeable LEGO tiles which either represent roads, parks, amenities, and residential or office buildings. The model also includes sliders and toggles which change the building height and switch between different mobility settings. When model users add or move such pieces, sliders or toggles, their changes are recorded and set to a digital analysis tool to provide feedback on the performance of their modifications. Such urban performance criteria were building energy per person, mobility energy per person, social wellbeing, and innovation potential (Alonso et al., 2018).

The practice of using LEGO in urban modeling will continuously be addressed in the remainder of this paper. From the Kendall Square model, their use of LEGO as a tangible interface aims to interactively engage stakeholders in urban planning (Grignard et al., 2018) and found that such visualizations helped to simplify complex urban systems, allowing for urban planning to become more transparent, data-driven, and evidence-based (Alonso et al., 2018). In a study done by the University of Siegen in Germany, their research team also looked for ways to make urban planning efforts more comprehensive and engaging, especially for youth and those in interdisciplinary fields. They found that interactive visualizations, especially augmented reality (AR) and virtual reality (VR), drastically improve participation and interaction with urban modeling efforts. They also used LEGOs as a preliminary participatory design test to learn what users prefer when asked to redesign urban environments. Their findings showed that users preferred LEGOs due to their tangibility and creation of a realistic scale relative to other objects (Saßmannshausen et al., 2021). In a study done by the Universidad Complutense de Madrid and University of Castilla-La Mancha, both in Spain, they discuss how LEGOs alone can be a powerful tool in teaching urbanism by making it easier to understand physical built environments, its' planning and design, and to adapt problem-based learning methodology. The study

points out LEGOs on their ability to do this in five categories. First versatility, which allows students to design, build, and program an infinite variety of solutions. Second is learning through playing and exploration, which ties directly into the third, hand-mind connection or constructionism, where LEGO bricks allow for interconnection between the brain and hands making formal and abstract ideas more tangible and easier to comprehend. Fourth is engagement, allowing students to have conversations with each other, promoting collaborative learning and working. Lastly, the cost of LEGOs make it an affordable tool in precollege or college laboratories (Mohino et al., 2017).

Our Partners

Like MIT's Media Lab, the University of Lyon's LabEx IMU is also researching urban dynamics using interactive 3D physical LEGO models. LabEx IMU aims to stimulate, produce, capitalize, and promote scientific and technical expertise on past, present and future urban worlds, while contributing to current and future urban developments. They have many members that participate in its projects; many of which being French laboratories, research groups, and students while also working with numerous partners, with some notable ones being the Metropolis of Lyon, City of Lyon and Renault Group. Since its establishment in 2011, the team has focused their research in incorporating nature in cities, mobility, green construction, digital cities, urban and environmental risks, metro politization, urbanization, technology and society and even urban density. Some recent research projects have focused on air quality, heat islands and urban green spaces in Lyon.

Our project partners are Gilles Gesquière, Corentin Gautier, and Johanna Delanoy of the Laboratoire d'InfoRmatique en Image et Systèmes d'information (LIRIS), a computer science research lab specializing in image processing, predictive algorithms, and information systems. Gilles Gesquière is a computer science professor at the University Lumière Lyon 2 and researcher in the CNRS LIRIS Lab. He was also the previous director of LabEx IMU and a member of the Management Committee of the Urban Schools of Lyon. He currently directs the VCity and UD-SV project under the LIRIS Lab, which is focused on processing and visualization of geospatial data to improve understanding of urban dynamics and life cycles. Our work with Gilles consisted of detailed demonstrations of their current model along with an interview discussing the strengths and future considerations of their model regarding its use of LEGO and interactive features.

Corentin Gautier is a Ph.D. computer science student within the Info/Maths doctoral school. He is currently an engineer in the TIGA project, which is dedicated to promoting the anchoring and transformation of industry in developing sustainable cities, industrial culture, and mobility. We worked primarily with Corentin, where we also received detailed demonstrations of the model, a demonstration on the model's digital components, and also an interview on discussing the strengths and future considerations of their model regarding its use of LEGO and interactive features. Lastly, we had weekly progress report meetings with Corentin where we received direct feedback on our project's efforts.

Johanna Delanoy is an associate professor in the LIRIS Lab and a professor at INSA Lyon. She was also a post doctorate researcher at the Graphics and Imaging Lab at the University of Zaragoza, Spain. We also had an interview discussing the strengths and future considerations of the model, however with a larger focus on its graphics and imagery due to her background.

Our Project

Using only white LEGO bricks, LabEx IMU built three models of Lyon, where data is then projected onto them conveying information on city dynamics. LabEx IMU aims to develop an understanding on data acquisition, processing, visualization, and manipulation to provide important context and solutions to those seeking and utilizing this data in urban development.

The setup begins with a technical station, which holds the model in the center on a table. The model is surrounded by an iron frame which holds a video projector, camera, display screen, control screen and light projectors, all of which contribute to the display of desired data. Data on urban concerns is uploaded to a digital model of the city, producing a digital twin of Lyon. Script from the digital twin model then provides instructions on the assembly of the LEGO model, giving important information such as building size, position, and density. This is then used to build the LEGO model, where the projection is then manually aligned on the model. The team is currently developing a camera recognition station, which can identify objects based on their color or shape. When specific color or shaped LEGO bricks are added to the physical model, these will then be rendered in the digital twin model. Lastly, the LEGO model would then be uploaded and displayed on an internal web application.

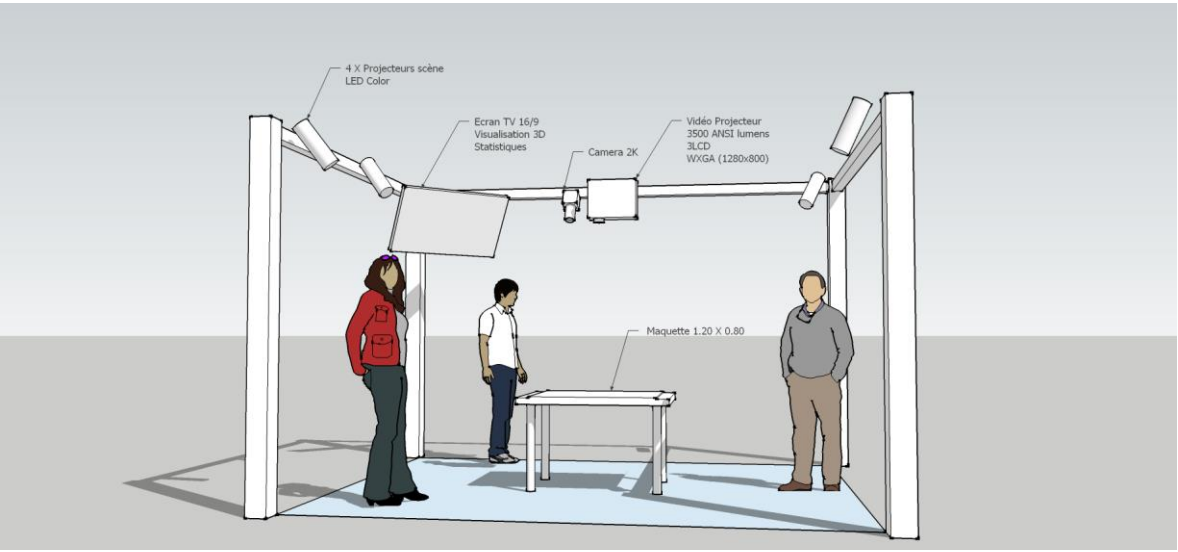

Figure 4: Diagram of the 3D LEGO Model Setup

Figure 5: Shows a 3D LEGO Model

Figure 6: 3D LEGO Model Displaying Data of Lyon's Vegetation

The mockup that we will be working with is a model of the Gratte-Ciel neighborhood located in Villeurbanne, as seen in Figures 5 and 6. The LEGO model mainly focuses on Avenue Henri Barbusse, a street mainly composed of shops and restaurants. The city is aiming to make the street only accessible to pedestrians to decrease traffic related issues such as smog and excess noise. The current use cases being projected on the model are vegetation, mobility, and noise pollution, with a demonstration that compares the time taken for a person walking down the street, a car, and potential new tramline to get from two points on the map, showing the potential efficiency of public transportation in the area. This is also accompanied by acoustics that depict the ambient noise perceived by the person when there are no cars on the street versus when motorists are allowed.

This model has been used to convey data on the locations of trees, green spaces, soil pollution and bus lines while also visualizing city pipelines, power lines, temperature, noise pollution and wind intensity. For our project, we will be focusing on green spaces, where we aim to propose the necessary improvements to the 3D LEGO model as to best demonstrate the importance and effects green spaces have on urban environments.

Methods

This chapter on methodologies will outline the strategy we used to carry out this project's goal, where four objectives have been delineated:

1. Determine Perspectives and Priorities for Urban Development in Lyon's Parks and Green Spaces
2. Understand Community Interaction with Green Spaces in Lyon
3. Evaluate the Successes and Challenges of the LabEx-IMU Model in Urban Planning

These strategies will combine qualitative and quantitative techniques to examine the model's present applications, identify its successes and weaknesses, and investigate cutting-edge locations like the MIT Media Lab. With this, perceptions and suggestions can be proposed to LabEx-IMU, that will guide future use of the 3D LEGO model to address urban issues in Lyon.

Objective 1: Determine Perspectives and Priorities for Urban Development in Lyon's Parks and Green Spaces

The first objective is to engage with residents and people of Lyon to determine their perspectives and priorities for urban development by conducting an online survey. It is critical to determine the priorities of the community related to its parks and green spaces to ensure that proposed use cases of city modeling tools match the wants and needs of who it affects. Gathering as much information as possible from the local community will help determine which areas in which the city of Lyon can look to improve. By identifying these areas, the 3D city model can be used to experiment with how these changes could manifest in the scope of the improving the city.

Surveys are a good way to get information on how to improve public parks and green spaces to meet the needs of the people of Lyon. The City of Worcester, Massachusetts, United States has used surveys as a tool to analyze and understand the opinions and experiences of its residents regarding public parks. The data gathered from the surveys was beneficial to understand how the city population utilizes the public spaces and what they feel could be improved. These results have been used by the city to develop and prioritize park improvement plans that better meet the needs of the residents (Worcester Department of Public Works and Parks, 2021).

QR codes will be used on flyers to distribute the survey within urban parks and streets with abundant foot traffic, with the main distribution being in the neighborhoods of Part-Dieu and Gratte-Ciel. People can easily and quickly access the survey on their mobile devices using this method, making it convenient for them to participate. This method, on the other hand, has some drawbacks because it requires people to be willing to take the survey and have access to a mobile device. Other conveyance techniques, for example, road approaches and meetings can likewise be investigated to arrive at a higher number of survey responses if the QR code is not returning enough results.

Figure 7: Survey Poster (Print)

Figure 8: Survey Advertisement (Online)

The goal of the survey questions is to find out how people use the parks, what is working well, what isn't, what problems are present in their current green spaces and if they have suggestions on how they can be improved, and what areas of Lyon they would like to see further developed and studied. The survey will be in French and will take less than 5 minutes to complete. How often citizens are visiting green spaces, how important parks are in choosing where they work and live, the quality of the green spaces, and general suggestions for improvements can be developed by analyzing these surveys collected data. Using what is gathered, the results will be presented to the sponsors to inform them on how they can adjust their approach to visualizing use cases on the models to better represent the needs of the citizens of Lyon-Villeurbanne.

(See Appendix A for a complete list of survey questions used.)

Objective 2: Understand Prominence of Green Spaces in Lyon

The second objective is to figure out how prominent green spaces are using mapping. Mapping is a technique which allows for data visualization through map creation. While there are many kinds of mapping techniques, the kind that will be used for this project is spatial mapping, which is the process of seeing how the community interacts with their environment by having them map out locations that they deem to be of interest (Beebe, 2012). This is an effective way to compile information into a concise, readable form which is easier to analyze and will help us obtain information about people's perception of the city and areas where people tend to frequent without having to go through the arduous process of interviews or surveys.

To begin the mapping process, a willing participant must be found, this will be through convenience sampling, or simply asking people who are available. They will be asked to make a rough outline of the district that we are in and any prominent locations that come to mind.

(See Appendix B for a script on how we will ask those to map the park)

They will do this by drawing a rough map of the district and the approximate locations of places they think are important. This process will be repeated several more times with different people to obtain a decent sample size. A decent sample size would be determined once the data becomes saturated. This process will be repeated multiple times in the Lyon area until a good sample size is collected.

Once a large enough sample is collected, analysis of the maps can begin. By looking at the various maps we collected, it can be clearly determined if any green spaces are important enough to people to mention in their maps. Similarly, it can be determined which spaces are not considered popular by seeing which areas are omitted from the maps. For all the maps, the type of areas mentioned and often they are mentioned can be recorded. Once it is known which areas are popular, a plan can be recommended to better implement green spaces in the future. In other words, a plan of action could be devised to make future green space developments in areas which the public believes to be devoid of green space.

Objective 3: Evaluate the Successes and Challenges of the LabEx IMU Model in Urban Planning, Along with Those of Other Modeling Projects

The third objective is to determine the successes and challenges of the LabEx IMU model. To gain a better understanding of the insights of both the creators and users of the LEGO model, semi-structured interviews will be conducted. To become more acquainted with the model and the visualization process, questions will be asked regarding the successes and challenges LabEx IMU has faced with the model as it exists. Then, by cross referencing that information along with data collected from other existing models, recommendations can be made on how the model could be improved.

The model's designers and users will be interviewed to better understand the advantages and disadvantages of using the 3D LEGO model in urban planning. Using open-ended questions that encourage respondents to relate their experiences and tell their stories is a successful method for conducting interviews (Berg et al., 2012). Beebe proposes that interviews can be conducted in a variety of methods, including face-to-face, over the phone, or online, in his chapter on "Data Collection - Multiple Data Sources and Triangulation." The interviews will be held in-person, at the University of Lyon. With consent, the interviews will be recorded to assure correct transcriptions and to facilitate later review and analysis. As a result, open-ended inquiries will be formulated that are suited to the experiences of the model's developers and users.

Some potential interview questions include:

- What inspired you to start using the 3D LEGO model in urban planning?
- What successes have you had with the model in terms of improving urban spaces and buildings?
- What challenges have you encountered when using the model?

(See Appendix C for a complete list of interview questions used.)

By conducting interviews with the creators and users of the model, valuable insights can be gained into the successes and challenges of using this model in urban planning. This information can help identify areas where the model can be improved and can help in developing strategies for using the model more effectively in the future.

One approach to analyzing the interviews with the developers and users of the 3D LEGO model for urban planning is to use a thematic analysis method. This approach involves recognizing and classifying different trends and topics that appear in the interviews. It can reveal the participants' experiences, viewpoints, and attitudes regarding the use of the LEGO model in urban planning (Berg et al., 2012).

There are several stages in thematic analysis. To fully understand the subject, the interviews would first be transcribed and recited over several times. Then, codes that represented specific concepts that emerged from the responses would be applied to various text parts. These codes would then be arranged into potential themes, which would be examined and improved as necessary to guarantee that they adequately reflected the data. The themes would next be understood and studied in relation to the research topic and the larger body of literature on sustainable urban development.

It is possible to gain important insights about the use and potential of the 3D LEGO model for urban planning by using thematic analysis to examine the interview data. It can be used to identify the model's advantages and disadvantages as well as possible areas for development. For instance, research may show that the model performs best when used to visualize the interactions between various city elements but performs worse when used to simulate the effects of human behavior on the environment. These revelations can guide the model's future use and evolution as well as more general urban planning choices.

The potential use of alternative modelling techniques and features to enhance the current model will be explored as well. Creators of other urban models will be interviewed, such as those involved in the many developed at the MIT Media Lab to gain insights on other challenges/successes incurred in others' modelling processes. The same questions we ask LabEx IMU about the development and findings of the LEGO model could be redirected to other modeling projects. By doing so, potential obstacles can be identified and presented to LabEx IMU to prevent future difficulties in developing the model. These interviews will be of similar length and analyzed in the same manner as those of LabEx IMU, however they will be conducted over video calls depending on their proximity to Lyon. If close, in-person interviews will be conducted. Doing so will expand insights on the many approaches, successes,

limitations, and future direction of similar projects, potentially proposing future adaptations for LabEx IMU's LEGO model.

(See Appendix D for a planned timeline of our data collection and analysis – Gantt Chart)

Findings

Surveys

The Beyond Lego team's initial objective was to assess the needs of the residents of Lyon regarding the development of green spaces in urban environments. To accomplish this, an online survey was conducted to gather data and insights. Additionally, 350 posters were printed and strategically displayed throughout the city of Lyon. The Part-Dieu district was primarily targeted, as there is heavy development ongoing in the area. With the revitalization of Rue Garibaldi, the addition of a new train station, housing projects, and other amenities, Part-Dieu was recognized as an ideal location to gauge the residents' opinions. Subsequently, the entirety of Lyon's 3rd district was covered in posters, which includes Part-Dieu. To maximize the visibility of the posters and ensure a wide reach, they were strategically positioned in high traffic areas.

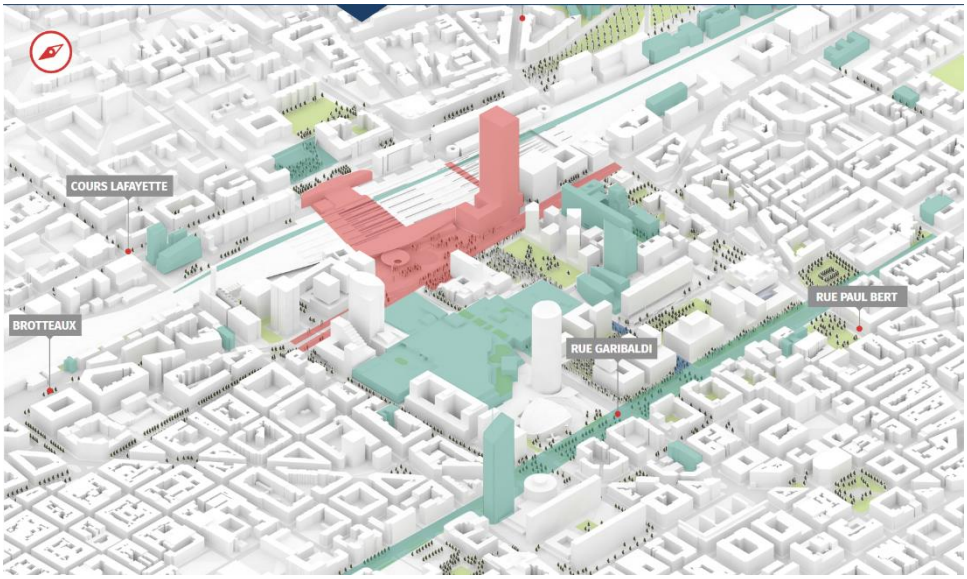

Figure 9: Developments in Lyon's Part-Dieu District

To ensure a diverse range of responses, the posters were displayed in various locations throughout Lyon. High foot traffic areas were targeted, including major parks like Parc de la Tete d'Or and Parc Sergent Blandan, the Université de Lyon, and Gratte-Ciel district, which is undergoing significant development. This approach allowed results to be collected from a diverse population and allowed for insights to be gathered regarding different segments of the community.

Figure 10: Posters at Tram Station in Lyon District 3

Figure 11: Poster in Gratte-Ciel District

In a one-month period of having the survey active, 139 responses were obtained. Overall, the results obtained showed that the citizens of Lyon often choose to go to parks and green spaces and care about their maintenance and availability. The open response questions used were very insightful into learning about micro and macro issues in green spaces and where the public would like to see more urban development throughout the city.

The first two questions that were asked in the survey related to how often residents visited parks in their areas and what their option was of their maintenance and upkeep. Question one found that half of respondents said they visited parks almost daily. Around 20% of responses indicated that they went to parks three or more days a week or more, and close to another 20% responded that they visit one to two days a week. This signifies that the Lyonnais residents value going to parks multiple times a week and that if more parks are to be planned that likely residents would use them often. The second question that related to upkeep of parks had more varied responses. It was found that 42% of people were somewhat satisfied with current upkeep and 20% being neutral on the matter. Whereas 25% of respondents suggested that they were unsatisfied with current maintenance of green spaces. There could be several reasons for this response, such as that the larger parks are better maintained than the smaller ones, or that different areas of the city have parks that are more well maintained.

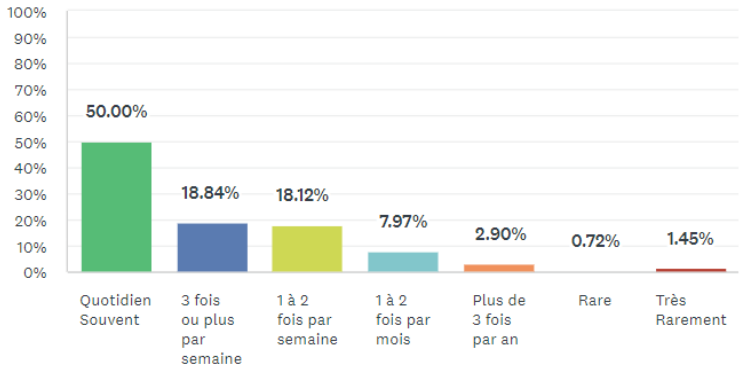

Figure 12: Results for Question 1 (How often do you visit green spaces in Lyon?)

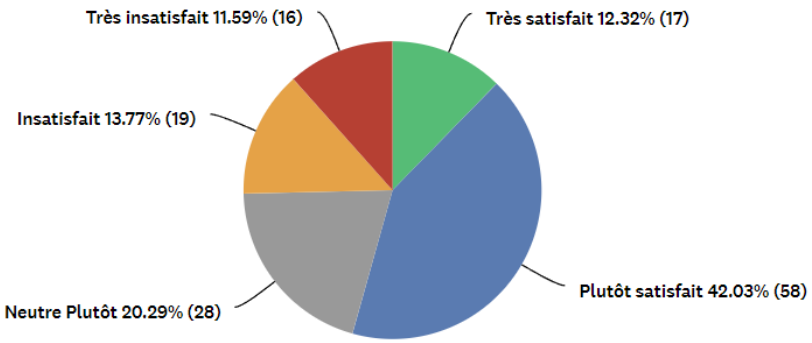

Figure 13: Results for Question 2 (Are you satisfied with the current maintenance and upkeep of green spaces in Lyon?)

The second quarter of our survey related to how important green spaces were to residents in choosing where to work and reside. Almost 90% of respondents signified that the availability of green spaces is very important in choosing where to live. This reaffirms that having a higher availability of green spaces in a neighborhood will often drive people to live in that area and invest in its success. Question four showed that around 70% say that green spaces have an impact on where they choose to work as well, with 40% saying that it is very important. Compared to the numbers of habitation, green spaces tend to have less of an impact on where Lyonnais citizens choose to work, yet still have an impact.

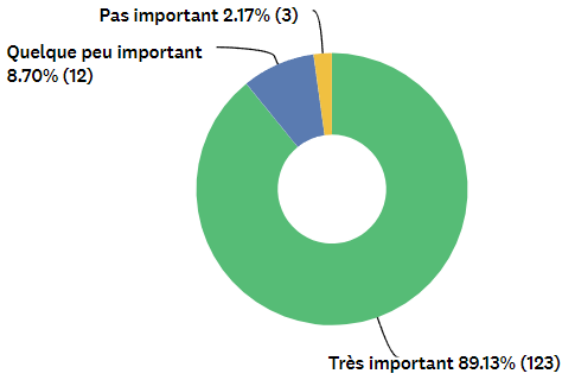

Figure 14: Results for Question 3 (How important are green spaces in choosing where you reside?)

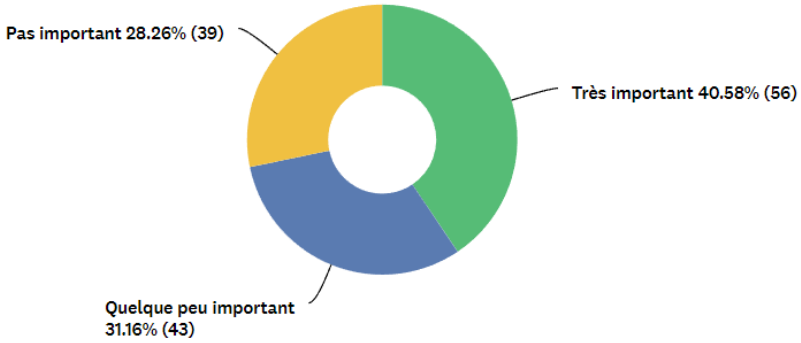

Figure 15: Results for Question 4 (How important are green spaces in choosing where you work?)

The next section of the survey relates to comparing Lyon's green spaces with other cities and if residents have noticed any changes in the quality of green spaces in the past few years. Most people responded that they are about the same with 52% of the data. Around 38% of people said that they were of worse quality. This conveys that the people of Lyon and Villeurbanne believe that the green spaces and parks can be improved to a higher standard. The next question showed that around 40% of citizens have not seen any change in the quality of green spaces in recent years, although around 30% there has been positive change in quality and availability of green spaces. This shows that the city of Lyon has been working more to implement and maintain green spaces over recent years.

Question seven was a free response question that sought to gain feedback on what citizens would like to see changed in the current parks in Lyon. Analyzing the responses, several themes emerged regarding the state of parks in Lyon. Firstly, there is a strong desire for more green spaces, with suggestions for additional trees, vegetation, and ecological lawns. Respondents also emphasize the

importance of providing recreational areas for children, including playgrounds and covered spaces to seek shelter during bad weather. Another significant theme is the need for better management and maintenance of the parks, including more frequent waste collection, additional garbage bins, and stricter enforcement of rules to prevent incivilities. There are also calls for designated areas for dogs and measures to address their needs, such as providing water points and enclosed spaces. Overall, the feedback highlights the importance of creating well-maintained, inclusive, and sustainable parks that cater to the needs of residents.

The final question asked public opinion on what areas in Grand Lyon Metropolis people would like to see further developed. The results gave us data that would aid in choosing future model locations that can be chosen to analyze more urban concerns. The highest number of respondents indicated that Villeurbanne, which is located east of the main area of Lyon, was an area that they would like to see continued development of. The model that LabEx currently has developed is that of Gratte-Ciel, in the center of Villeurbanne, which houses its city hall and public offices. This result proved that the area of Lyon that LabEx IMU is focusing on aligns with the wishes of its residents. Other areas that were highlighted with many respondents were Lyon 3eme, which includes Part-Dieu, with the second highest response rate, and 8eme, 7eme, and 6eme. These locations can be considered to create future iterations of the LEGO model to continue to analyze the need for future development of green spaces in Lyon.

Figure 16: Word Cloud for Question 8 Responses (Quels autres quartiers de Lyon souhaiteriez-vous voir se développer plus?)

Mapping

The next method to be completed was the mapping. In mapping, participants would be asked to draw a map of the surrounding area from memory, which highlighted the areas they deemed of importance. In regarding this project, if green spaces were drawn, it was deemed they were prevalent enough to be of importance in the district. If green spaces were not drawn, it was deemed that there were not enough green spaces in the surrounding area. Mapping was conducted in Gratte-Ciel, in which LabEx currently has depicted in the LEGO model. This was determined to be a prime target for mapping as it is a high foot traffic area, also undergoing heavy development. In total, thirteen maps were developed.

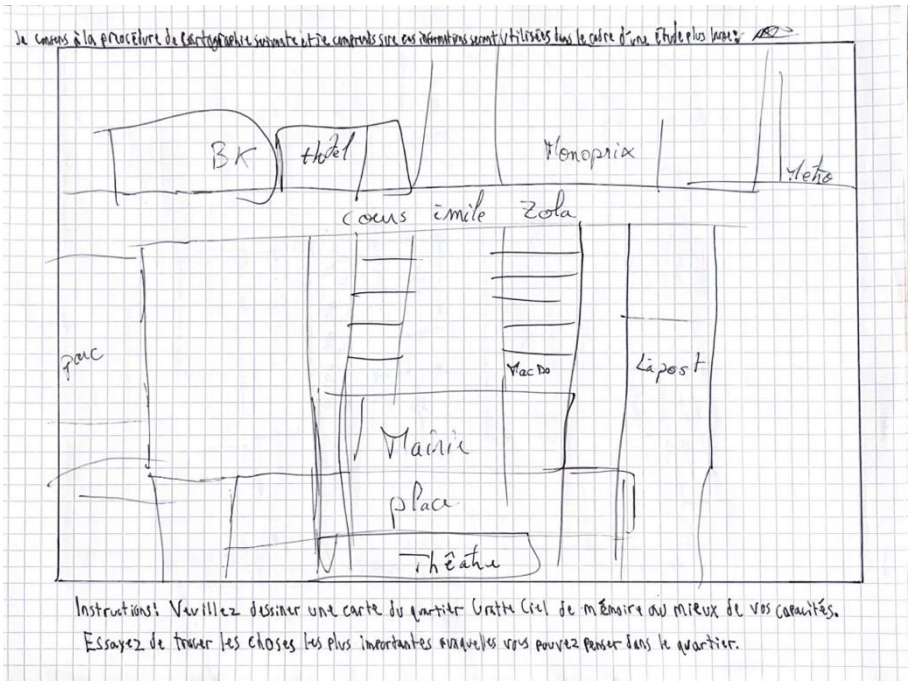

Figure 17: An example of a map that focuses more on the Gratte-Ciel shopping district.

The participants who engaged with our mapping activity ranged from young adults to retirees, which allowed us to gain many perspectives. The maps fell into two categories, those being maps that showed the shopping district and nearby buildings, and those that focused more on Gratte-Ciel as a whole. The overwhelming majority of the maps focused on the shopping district, such as the one in Figure 17. However, there were still some maps that displayed areas not near the shopping district, such as the one in Figure 18. As for green spaces, only five of the maps in total showed any green spaces, and only one of the maps displayed any prominent green spaces such as parks. The five maps that displayed other forms of vegetation indicated the presence of trees, as the shopping district was lined with such. Figure 1 is also an example of a map that drew vegetation in this way.

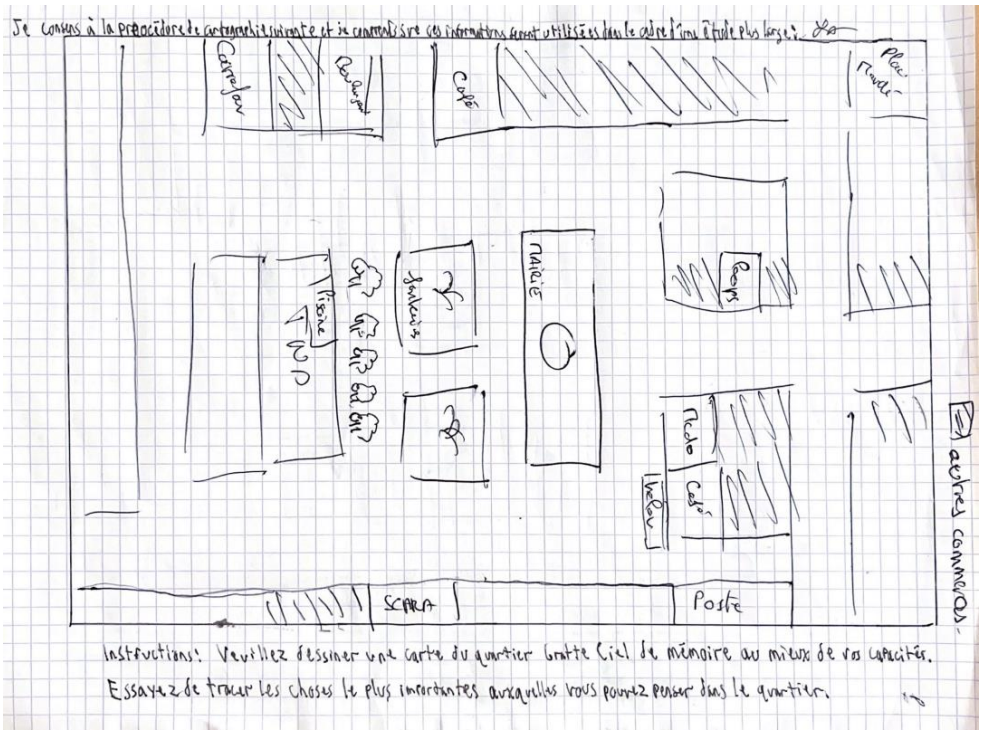

Figure 18: An example of a map that did not focus primarily on the shopping district

Most maps seemed to focus on either businesses or public spaces. As seen in Figure 19, out of the thirteen maps we had, only one map did not include any business, and ten maps included public buildings. Comparing those figures to the number of maps with greenery in them shows that people tended to focus significantly less on the local vegetation in the area, which could be due to green spaces not having much prominence in the area when compared to businesses and public buildings, meaning that the area of Gratte-Ciel does not have enough green spaces. This can be seen in the lack of any parks being mentioned on most maps, which points towards the fact that the parks are not in ideal locations and that they are so few that the public does not feel their impact as heavily as the impact of other kinds of buildings, such as businesses and public buildings. Green spaces have a significant positive impact on the surrounding area, therefore Gratte-Ciel will see incredible improvements with the addition of new green spaces which can be planned out with the LEGO model.

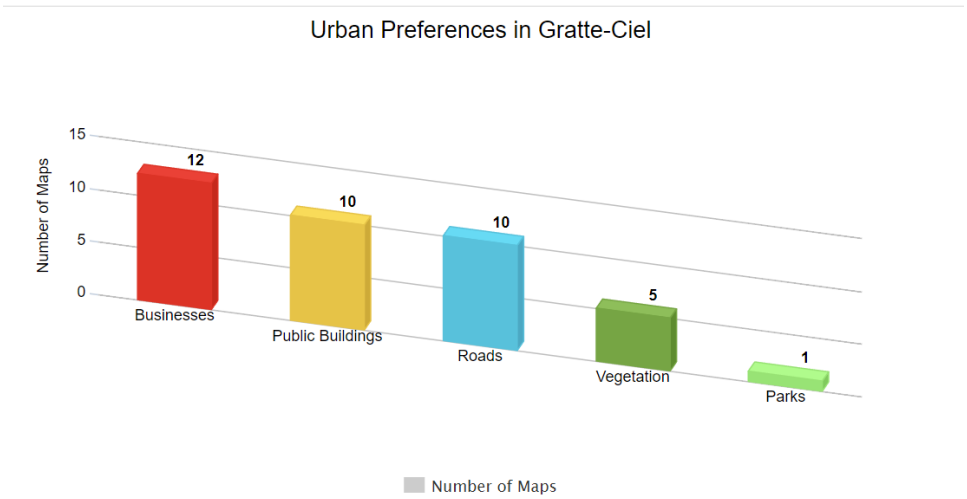

Figure 19: A graph displaying the number of maps which included greenery, businesses, and public buildings.

Using this mapping data, a 2D projection of Gratte-Ciel was developed to be displayed on the current LEGO model. Using the prevalence of certain responses for certain roads, business, and buildings a heat map was developed regarding the prevalence of what people put on their map of the area. This graphic can be used to understand where people tend to congregate or visit in the area and aid decisions of where to place public amenities, such as parks and tram stations. On the map, red visualizes the most prevalent responses going to orange, yellow, green, and blue being the least number of responses.

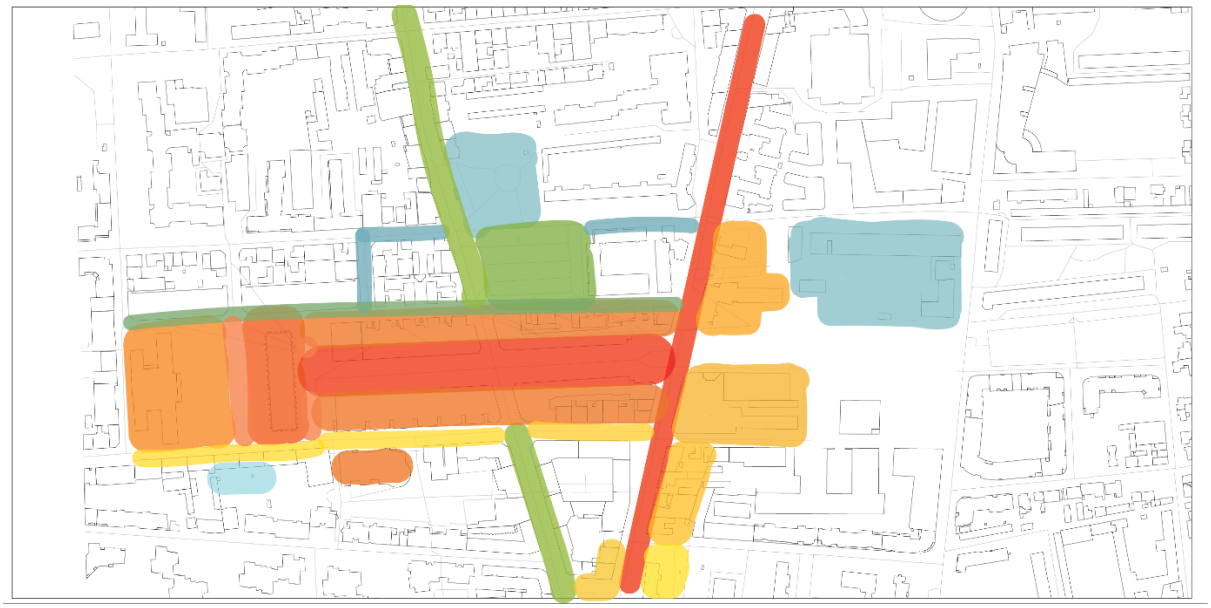

Figure 20: Heat Map Projection for Gratte-Ciel Lego Model using Mapping Data

Interviews

Much was learned about the model's successes, challenges, and desired future direction from the creators at LabEx IMU. The interviews were analyzed and grouped into two major sections, successes and potential developments, where future recommendations could be built for improvements on their model.

The successes of the LabEx IMU model were grouped into three categories, those being: usability, engagement, and cost. LEGOs are very easy to use, as LEGOs allow for reproducibility and replaceability when constructing new models and use cases. Multiple models could be made along with being changed with very little time or energy. The Gratte-Ciel model this project focused on took LabEx IMU a week to construct, compared to longer timeframes for larger 3D printed models. Additionally, the model's mobility greatly contributes to its usability. The projection equipment is stored in a cubic meter box near the model as the LEGO model itself can be broken down into smaller pieces. This allows for easy transportation and deployment, where the model can be fully assembled in less than an hour.

LEGOs are extremely engaging and play a pivotal role in attracting attention and participation to the model. LEGO instantly grabs the interest of people, especially in younger audiences. When deploying a LEGO model in Paris during an exhibition, the model creators observed spectators smiling when looking at the model. This familiarity and attraction allow the model to be more approachable. However, LEGOs are just one part of the equation. The utilization of digital projections further enhances the model's ability to captivate spectators, especially through moving visuals and audio.

Lastly, LEGO bricks are cost-effective, as they can be purchased in bulk at a significantly lower price than other modeling techniques.

However, no model is perfect. The potential developments of LabEx IMU's model were also grouped into two categories, those being further implementation of interactive features and revisions on the current modeling components. LabEx IMU wants to include more interactive features, including the ability to move buildings around and having the projection update in real time to get feedback, like the MIT Media Lab's Kendall Square model. LabEx stated that more interactive models are more captivating and allow for greater learning opportunities.

LabEx IMU is also hoping to address the construction and appearance of their model. When constructing the model, a CSV file is developed using a digital application called UD-VIZ, developed by LabEx, which describes where bricks should be placed and how high, however these dimensions are different from that of standard LEGO bricks. This makes it time consuming to decide which type of brick to use and where. LabEx also mentioned a want for greater or smaller geometric and physical details in buildings and roads depending on their importance or prominence., allowing for more famous or prominent buildings to be easily recognizable to the user.

Another challenge is coordinating the projection with the LEGO model. Currently, the projections must be manually aligned with the physical model. As a result, there is an emphasized desire to find a way to have the projection automatically align with the physical model as to eliminate the time required to manually align it. Additionally, the current system includes a single projector, which causes unavoidable shadowing on the model due to the model's size. LabEx IMU is hoping to address this in the future by possibly changing the construction of the model, such as making buildings smaller than they are, or using multiple projectors. LabEx IMU believes that these improvements will allow the model to be more realistic and easily usable, subsequently allowing for users to better engage with and comprehend the model and its data.

For future use cases, the model creators at LabEx IMU want to continue their use case of urban vegetation, stating how a desire for urban planners to use this tool to show how vegetation brings a better quality of life. LabEx also wants to continue their work on urban mobility, strongly emphasizing that the model they can show urban planners and stakeholders the potential of an improved public transportation network in the city. Stepping outside of current use cases, they have also presented new ideas such as modeling fire fighter routes and even soldiers on battlefields.

Dr. Luis Alonso Pastor of MIT City Science was also interviewed regarding the successes and challenges of MIT's model. Dr. Alonso is a research scientist at MIT Media Lab and principal investigator of the Andorra Living Lab Project, a 3D topographical model of two cities in Andorra which provided a detailed representation of the cities, people's movement, and amenities' popularity and density. This model simulated visitors' attendance and traffic congestion during two annual events in the cities (Grignard et al., 2018).

MIT Media Lab's successes were grouped into two categories, those being interactive engagement and usability. Like the responses from LabEx IMU, Dr. Alonso strongly emphasized LEGO's engaging capabilities, emphasizing how they engage the community and intentionally built 3D LEGO models to allow users to play and interact with the models. On the Kendall Square model, Dr. Alonso mentioned that people were afraid of using the digital model, as they were unfamiliar with the application and were afraid of breaking it. Participants were much more comfortable with the LEGO model due to the familiarity of LEGOs and the analogue nature of them. LEGO's usability was also remarked on, stating how an overarching goal of their team is reproducibility, in which they have done with modeling projects around the world, including Lyon in a collaboration with LabEx IMU.

Areas of improvement were also mentioned by Dr. Alonso, where an addition of more interactive features could improve the model's effectiveness. Dr. Alonso states new ways must be found to include interaction and finding new ways to model data. He proposed the use of predictive algorithms, which had key functions in the Andorra model. It's use provided real time feedback to users on changes they made to the model. An obstacle of these current features are their complexity, where adding such features can be costly, time consuming and difficult, requiring experts in specific fields. With this technology, MIT's next steps are to understand and model human behavior, something that is an extremely complex and ever-changing task. Dr. Alonso also recommended having a diverse team to help

improve the model to make the model appeal to larger audiences. It was stated that certain use cases, such as urban safety, are more likely to be addressed with certain groups.

Another case study MIT is currently researching is carbon emissions in urban environments. City Science has explained such to the United States Congress using 3D urban modeling advocating for reduced carbon emissions, footprints, and further implementation of electric vehicles.

Recommendations

From all the data collected; the model should be used to figure out ways to place more green spaces in the Gratte-Ciel district. From the surveys it is clear the public cares about green spaces and parks and wishes to see them expanded upon in serval different areas of the city. Mapping showed that the Gratte-Ciel district has a distinct lack of parks, or rather that there are not any parks that are considered prominent enough for locals to place on a map of the most important areas in the neighborhood. With this, it can be said that the Gratte-Ciel district needs more parks that the people can enjoy. Utilizing the model to visualize solutions for more parks would allow it to gain new functionality while also having a positive impact on the people living in Gratte-Ciel.

From the conducted interviews, it was found that future implementation of interactive features is necessary in producing a comprehensive and effective model when conveying information about urban issues and concerns. Although some interactive features of LabEx IMU's current model are still under development, improvement in the connection between the physical LEGO model and the digital model must first be implemented to make the next step. As seen with the MIT Media Lab's model of Kendall Square, the direct connection between the physical and digital model provides the necessary feedback on proposed changes in the urban environment to users. This immediate feedback allows for a greater understanding on how such changes influence urban dynamic systems, allowing for collaborative conversations between model creators, urban planners, and stakeholders on proposing solutions on urban concerns.

Additional features to the model can be utilized such as augmented reality (AR), predictive algorithms, and virtual reality (VR). AR is a powerful tool that can combine our physical world with virtual 3D visuals. It could be a beneficial tool to implement with the LEGO model as multiple users would be able to see real time projections as well as place objects in the virtual space onto the physical LEGO model with ease. It is features such as these that we believe will further captivate people into participating in urban design conversations with LabEx IMU's model while opening new avenues of teaching and comprehending urban issues.

On the use case of green spaces, specifically in the Gratte-Ciel district, it is suggested that a series of new projections are developed to illustrate the benefits of introducing more green spaces to the area. It is suggested that three main sets of projections are created. The first will be a projection of

only current vegetation and green spaces in the district with vegetation and green spaces drawn on mapping results highlighted. This projection will illustrate the lack of green spaces in Gratte-Ciel in a comprehensive way through engaging visuals of the public's responses and city data, acquired from the Grand Lyon website.

Next, more projections should be created to show how further implementation of vegetation in the area can address other urban concerns, such as air and noise pollution and urban heat islands. In showing heat maps of such issues, the connection between a lack of green spaces and urban issues can be shown once again in a comprehensive way through engaging visuals. This data will also be acquired from the Grand Lyon website.

It is also heavily recommended to incorporate interactive features to the modeling system. Using a system that updates in real time as users make changes to the physical model is imperative in capturing and engaging citizens to participate in conversations on developing urban areas. With this, citizens will be able to easily understand urban issues and their effects, form conversations on such, and propose solutions. This can be done by placing colored LEGO bricks that represent parks or some amounts of vegetation using camera recognition or AR technology, then updating the heat map projections with such changes, seeing how the proposed changes mitigate the previously mentioned urban issues and how this impacts the individual.

Lastly, a narrative should be developed surrounding this series of projections. This will incorporate visual movements and audio representing the daily activities of an average citizen. This will illustrate how green spaces affects the individual. These stories will be strongly based on those surveyed and those involved with mapping. This will create a cohesive narrative to go along with the projections that provide relatability to the model viewers along with an engaging story showing why people should care about improving and further implementing green spaces in Lyon.

An example of these features in action would start with forming our characters. The character's stories will be based off of responses received in surveys and mapping. Let's say character one lives in a dense residential area with no vegetation. Using city data, we can see that character one's residence experiences high air and noise pollution and ambient heat, which affects their overall mental and physical health. Compare this to another character. Character two lives next to a park, where they experience reduced levels of air and noise pollution along with reduced ambient heat, where this person is much healthier than character one. This directly presents how the individual is affected by such urban issues that directly correlate with the presence of green spaces. Then through interactive features, model participants can change the system, seeing how implementing vegetation and green spaces change the heat map of the previously displayed urban issues along with predictive algorithms that simulate the characters' health and wellbeing as a result of said changes.

Conclusions

These recommendations will achieve several things to improve LabEx IMU's model's effectiveness. First, through the survey, mapping, and proposed recommendations, the public involvement and participation with the urban LEGO model will greatly increase. This subsequently will educate larger masses of people on urban issues while involving them in collaborative conversations on solutions to such issues. In this proposed use case, communication between urban planners and the concerns of citizens can begin. Through conveying the lack of and desire for more vegetation in the Gratte-Ciel district, along with its immediate effects, urban developments can be improved to further incorporate vegetation and green spaces to improve the quality of life for individuals, and that of greater Lyon.

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Appendix

Appendix A – Lyon Park Survey Questions

Surveys: Gather the opinions and experiences Lyonnaise residents have on current green spaces and parks.

Consent Script:

English

Welcome to our online survey on Lyon's parks and green spaces. Before we begin, we want to inform you that your participation in this survey is voluntary. The purpose of this survey is to gather information about your experiences and opinions regarding parks and green spaces. The data collected will be used for research purposes only and will be kept confidential. Your responses will be anonymous, and no personally identifiable information will be collected. By agreeing to participate in this survey, you are acknowledging that you have read and understood the information provided, and that you consent to participate. Please answer the questions truthfully and to the best of your ability.

French

Bienvenue à notre enquête en ligne sur les parcs et espaces verts de Lyon. Avant de commencer, nous tenons à vous informer que votre participation à cette enquête est volontaire. Le but de cette enquête est de recueillir des informations sur vos expériences et opinions concernant les parcs et espaces verts. Les données collectées seront utilisées à des fins de recherche uniquement et resteront confidentielles. Vos réponses seront anonymes et aucune information personnellement identifiable ne sera collectée. En acceptant de participer à cette enquête, vous reconnaissez que vous avez lu et compris les informations fournies et que vous consentez à y participer. Veuillez répondre aux questions honnêtement et au mieux de vos capacités.

Survey Questions Relating to Quality of Green Spaces:

1. How often do you visit green spaces in Lyon?
    - Daily
    - Often (3 or more times per Week)
    - 1-2 Times per week
    - 1-2 times per month
    - Very Rarely (more than 3 times per year)
    - Rarely

2. Are you satisfied with the current maintenance and upkeep of green spaces in Lyon

Very Satisfied
Somewhat Satisfied
Neutral
Somewhat Dissatisfied
Very Dissatisfied

3. How important are green spaces in choosing where you reside?
   Very Important
   Somewhat Important
   Not Important

4. How important are green spaces in choosing where you work?
   Much Better
   Better
   Equal
   Worse
   Much Worse

5. How do Lyon's green spaces compare to green spaces in other cities you've visited?
   Much Better
   Better
   Equal
   Worse
   Much Worse

6. Have you noticed any changes in the quality or availability of green spaces in Lyon in recent years?
   Very Positive Change
   Positive Change
   No Change
   Negative Change
   Very Negative Change

7. Are there any specific improvements or additions you would like to see in green spaces in Lyon?
   (Free response Question)
8. What areas of Lyon would you like to see further developed?
   (Free response Question)

French Translation

1. A quelle fréquence vous visitez les espaces verts à Lyon?
    - Quotidien Souvent
    - 3 fois ou plus par semaine
    - 1 à 2 fois par semaine
    - 1 à 2 fois par mois
    - Très Rarement
    - Plus de 3 fois par an
    - Rare
    - Tres Rarement

2. Etes-vous satisfait de la maintenance et de l'entretien actuels des espaces verts à Lyon?
    - Très satisfait
    - Plutôt satisfait
    - Neutre Plutôt
    - Insatisfait
    - Très insatisfait

3. Quelle est l'importance des espaces verts dans le choix de votre lieu de résidence?
    - Très important
    - Quelque peu important
    - Pas important

4. Quelle est l'importance des espaces verts dans le choix de votre lieu de travailler?
    - Très important
    - Quelque peu important
    - Pas important

5. Comment les espaces verts de Lyon se comparent-ils aux espaces verts des autres villes que vous avez visitées?
    - Bien mieux
    - Mieux Égal
    - Pire Bien
    - Pire

6. Avez-vous remarqué des changements dans la qualité ou la disponibilité des espaces verts à Lyon au cours des dernières années
    - Changement très positif
    - Changement positif
    - Pas de changement

Changement négatif
Changement très négatif

7. Y a-t-il des améliorations ou des ajouts spécifiques que vous souhaiteriez voir dans les espaces verts à Lyon?
(Question à réponse libre)

8. Quels autres quartiers de Lyon souhaiteriez-vous voir se développer plus?
(Question à réponse libre)

Appendix B – Mapping script

Basic script for talking to people:

"Hello, we are currently doing a study about how people perceive the city if Lyon and its green spaces, would you be willing to participate, it will only take a couple of minutes

[If not interested in participation] "No worries, thank you for your time, have a good day"

[If interested in participation] "Great! Could you please draw a map of the Gratte-Ciel District from memory to the best of your ability. Try to plot out the most important things that you can think of in the district.

[When/if map is completed] "Thank you for participating in this study! We appreciate your input, and we will be sure that this data will be used to better Lyon. For more information on our project, please look up "Labex IMU" or go to [insert website link here] for more information on our research.

French Translation
"Bonjour, nous menons actuellement une étude sur la façon dont les gens perçoivent la ville si Lyon
[Si pas intéressé par la participation] "Pas de soucis, merci pour votre temps"
[Si vous êtes intéressé par la participation] « Super ! Pourriez-vous s'il vous plaît dessiner une carte du quartier Gratte-Ciel de mémoire au mieux de vos capacités. Essayez de tracer les choses les plus importantes auxquelles vous pouvez penser dans le quartier.
[Quand/si la carte est terminée] « Merci d'avoir participé à cette étude ! Nous apprécions votre contribution et nous serons sûrs que ces données seront utilisées pour améliorer Lyon. Pour plus d'informations sur notre projet, veuillez consulter « Labex IMU » pour plus d'informations sur nos recherches.
Instructions:
Please draw a map of the Gratte-Ciel District from memory to the best of your ability. Try to plot out the most important things that you can think of in the district.

Veuillez dessiner une carte du quartier Gratte-Ciel de mémoire au mieux de vos capacités. Essayez de tracer les choses les plus importantes auxquelles vous pouvez penser dans le quartier.

Consent Form:
I consent to the following mapping procedure and understand that this information will be used as part of a larger study.
Signature:_____
French Translation
Je consens à la preocédure de cartographie suivante et je comprends sue ces informations seront utilisées dans le cadre d'une étude plus large
Signature:_____

Appendix C - Interview Questions

Consent Form:

Thank you for making the time to meet with us. Before we begin the interview, we want to inform you that your participation in this interview is voluntary. The purpose of this interview is to gather information about the successes and challenges of your model as to propose developments for LabEx IMU's 3D LEGO model to better display data on green spaces. The data collected will be used for research purposes only and will be kept confidential. Your responses will be anonymous, and no personally identifiable information will be collected. By participating in this interview, you are acknowledging that you have read and understood the information provided, and that you consent to participate.

Signature:_____

French Translation
Merci d'avoir pris le temps de nous rencontrer. Avant de commencer l'entretien, nous tenons à vous informer que votre participation à cet entretien est volontaire. Le but de cet entretien est de recueillir des informations sur les réussites et les enjeux de votre maquette afin de proposer des évolutions pour la maquette 3D LEGO du LabEx IMU afin de mieux visualiser les données sur les espaces verts. Les données collectées seront utilisées à des fins de recherche uniquement et resteront confidentielles. Vos réponses seront anonymes et aucune information personnellement identifiable ne sera collectée. En participant à cette entrevue, vous reconnaissez avoir lu et compris les informations fournies et consentez à y participer.

Signature:_____

Questions Asked to Candidates with Place to Write Response and Notes:

Goal of Question	Question	Candidate Response	Interviewer Notes/Observations
Icebreaker	Tell me about what inspired you into pursuing a career in…		
Approach	What inspired you to start using the model in urban planning?		
Results	What successes have you had with the model in terms of improving urban spaces?		
Results	What challenges have you encountered when using the model?		
Future Direction	How do you envision the model being used in the future to improve urban planning and sustainability efforts?		
Future Direction	What suggestions do you have for improving the model's functionality and effectiveness?		

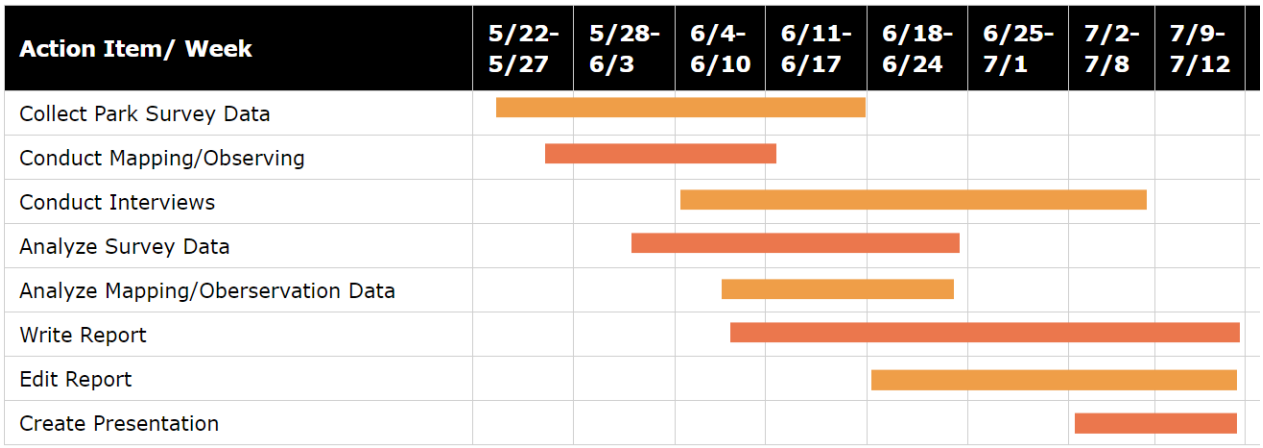
French Translation

Goal of Question	Question	Candidate Response	Interviewer Notes/Observations
Icebreaker	Parlez-moi de ce qui vous a poussé à poursuivre une carrière en…		
Approach	Qu'est-ce qui vous a inspiré pour commencer à utiliser le modèle en urbanisme?		
Results	Quels succès avez-vous eu avec le modèle en termes d'amélioration des espaces urbains?		
Results	Quelles difficultés avez-vous rencontrées lors de l'utilisation du modèle?		
Future Direction	Comment envisagez-vous que le modèle soit utilisé à l'avenir pour améliorer les efforts		

	d'urbanisme et de développement durable?		
Future Direction	Quelles suggestions avez-vous pour améliorer la fonctionnalité et l'efficacité du modèle?		

Appendix D – Gantt Chart

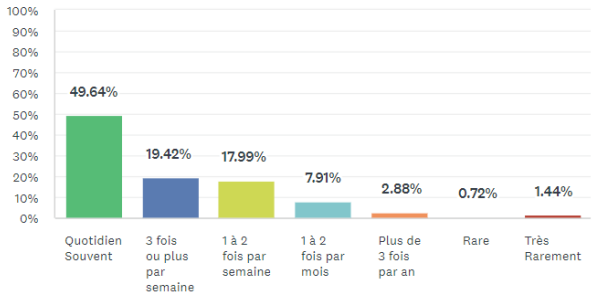
Timeline for methods and analyzing



Appendix E – Survey Results

A quelle fréquence vous visitez les espaces verts à Lyon ?

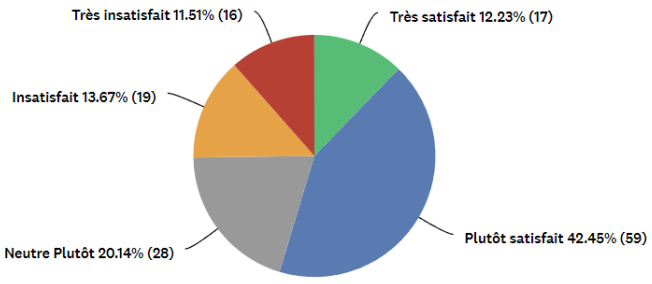
Answered: 139 Skipped: 0



ANSWER CHOICES	RESPONSES	
Quotidien Souvent	49.64%	69
3 fois ou plus par semaine	19.42%	27
1 à 2 fois par semaine	17.99%	25
1 à 2 fois par mois	7.91%	11
Plus de 3 fois par an	2.88%	4
Rare	0.72%	1
Très Rarement	1.44%	2
TOTAL		139

Etes-vous satisfait de la maintenance et de l'entretien actuels des espaces verts à Lyon?

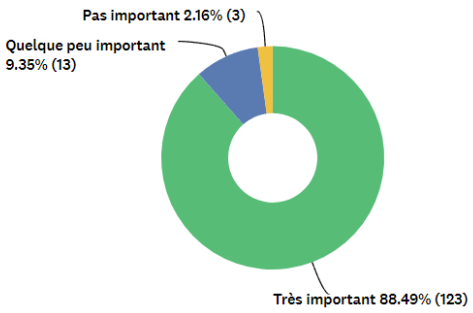
Answered: 139 Skipped: 0



ANSWER CHOICES	RESPONSES	
Très satisfait	12.23%	17
Plutôt satisfait	42.45%	59
Neutre Plutôt	20.14%	28
Insatisfait	13.67%	19
Très insatisfait	11.51%	16
TOTAL		139

Quelle est l'importance des espaces verts dans le choix de votre lieu de résidence?

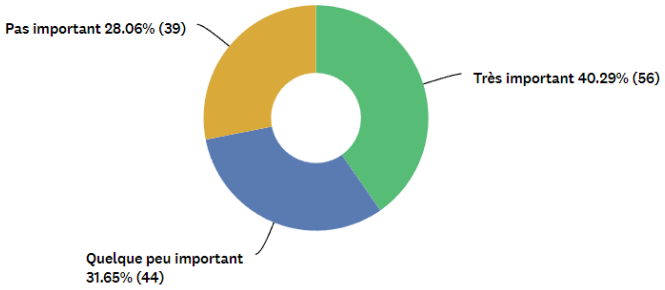
Answered: 139 Skipped: 0



ANSWER CHOICES	RESPONSES	
Très important	88.49%	123
Quelque peu important	9.35%	13
Pas important	2.16%	3
TOTAL		139

Quelle est l'importance des espaces verts dans le choix de votre lieu de travailler?

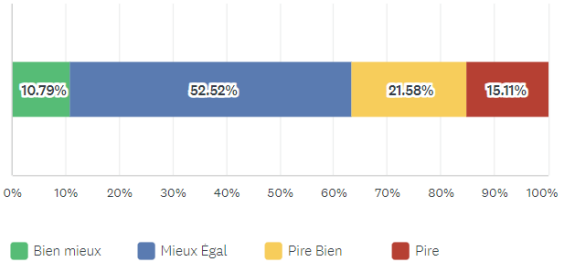
Answered: 139 Skipped: 0



ANSWER CHOICES	RESPONSES	
Très important	40.29%	56
Quelque peu important	31.65%	44
Pas important	28.06%	39
TOTAL		139

Comment les espaces verts de Lyon se comparent-ils aux espaces verts des autres villes que vous avez visitées?

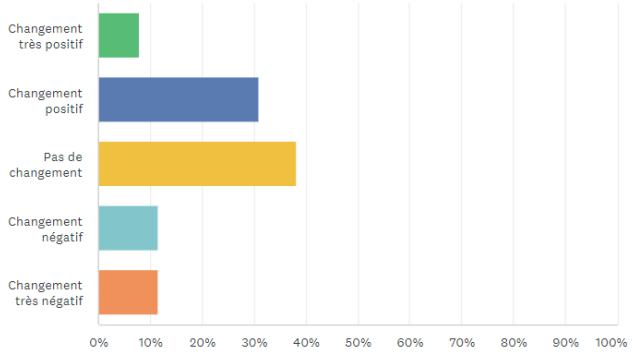
Answered: 139 Skipped: 0



ANSWER CHOICES	RESPONSES	
Bien mieux	10.79%	15
Mieux Égal	52.52%	73
Pire Bien	21.58%	30
Pire	15.11%	21
TOTAL		139

Avez-vous remarqué des changements dans la qualité ou la disponibilité des espaces verts à Lyon au cours des dernières années?

Answered: 139 Skipped: 0



ANSWER CHOICES	RESPONSES	
Changement très positif	7.91%	11
Changement positif	30.94%	43
Pas de changement	38.13%	53
Changement négatif	11.51%	16
Changement très négatif	11.51%	16
TOTAL		139

Question 7 Responses

Q7 Y a-t-il des améliorations ou des ajouts spécifiques que vous souhaiteriez voir dans les espaces verts à Lyon? (Question à réponse libre)

Answered: 139 Skipped: 0

#	RESPONSES	DATE
1	Laisser davantage d'espaces "biodiversité" (pas de tonte, jachères mellifères etc.). Mettre plus de haies.	7/3/2023 1:37 PM
2	Des potagers avec des stages pour les enfants	7/2/2023 5:59 PM
3	Il faudrair casser le béton et renaturaliser la majorité des voies piétonne	6/29/2023 4:35 PM
4	Collecte des déchets en du printemps à l'automne plus souvent et plus de poubelles. Coupe des épillets qui sont dangereux voir mortels pour les chiens, distributeurs de sacs à déjections canines, plus de surveillance pour les incivilités (jets de pierres sur personnes, enfants, chiens, agressions, trottinettes qui roulent à fond dans les parcs)	6/29/2023 10:48 AM
5	des endroits couverts, comme des préaux où l'on pourrait se mettre à l'abri en cas d'intempérie	6/28/2023 6:07 PM
6	Faire respecter l'interdiction des chiens	6/28/2023 11:48 AM
7	ptn ce sondage est si nul	6/27/2023 10:04 PM
8	NC	6/27/2023 6:24 PM
9	Plus de Pelouse écologique	6/27/2023 1:19 PM
10	Plus d'animaux	6/27/2023 11:44 AM
11	Plus de végétation	6/27/2023 11:31 AM
12	J'aimerais qu'il y en ait plus, même des petits.	6/26/2023 8:01 PM
13	Plus d'arbres ou ilots verts	6/26/2023 6:35 AM
14	Regulation des vélos et trotinettes. Voies dediees	6/25/2023 2:20 PM
15	Aucun commentaire	6/25/2023 11:01 AM
16	Plus d'arbres pour plus d'ombre.	6/25/2023 10:54 AM
17	Plus de crottes de chiens, de pisse humaine, de sans-abris avec leurs tentes et leurs déchets, plus de poubelles qui débordent attirant les rats. Plus de mecs bourrés qui se battent devant les enfants ! En gros, plus de surveillance et de sanctions sur les mauvais comportements	6/25/2023 9:35 AM
18	Développer les jardins participatifs	6/25/2023 8:42 AM
19	Plus d'arbres pour avoir plus d'ombre afin de répondre aux températures montantes avec le réchauffement climatiques. Séparer les zones pour les chiens car les propriétaires de chiens vient dans tous les espaces sans forcément nettoyer après.	6/24/2023 7:42 PM
20	Plus de pelouse verte	6/24/2023 5:44 PM
21	Privilégier les pelouses, les toilettes et points d'eau, les pochettes à tri sélectif	6/23/2023 7:15 PM
22	Plus de jeux pour les enfants	6/23/2023 2:25 PM
23	plus de moyens pour les développer	6/23/2023 9:32 AM
24	Des zones de qualité pour les chiens + arrêter la répression sur les chiens	6/22/2023 1:30 PM
25	Mon appréciation négative des espaces verts concernent ceux de mon quartier, aux gratte-ciel de Villeurbanne. Tous sont en très mauvais état, les pelouses disparaissent car les enfants ont besoin de cet espace la pour jouer au ballon. Si les lyonnais veulent des pelouses, il faut	6/22/2023 12:34 PM

	plus d'espace de jeu pour les enfants. De plus dans mon quartier l'interdiction aux chiens n'est pas du tout respectée et les parcs sont salis et dangereux à cause de cela	
26	Plus de bassin artificiel dans les parc. Également plus d'entretien des bassins qui sont un peu oubliés. Et une dernière demande, plus de dispositifs antimoustique autour des parc.	6/22/2023 12:10 PM
27	Plus d'espaces verts clos pour les chiens	6/21/2023 8:02 PM
28	Plus de points d'eau potable	6/21/2023 7:48 PM
29	Contrôle des comportements	6/21/2023 12:45 PM
30	Moins de chiens en liberté dans les parcs quand il y a les enfant	6/21/2023 10:27 AM
31	Non pas spécialement	6/21/2023 9:48 AM
32	Espace chien ou horaire pour chien	6/20/2023 8:14 PM
33	Plus de variétés locales et une meilleure protection des animaux au parc de la tete d or	6/20/2023 4:46 PM
34	Entretien, ombrage, point d'eau des espaces de jeu pour enfants. Surtout à Villeurbanne.	6/20/2023 4:25 PM
35	pas bcp d'activité	6/20/2023 4:23 PM
36	Il n'y a plus de pans au parc	6/20/2023 4:22 PM
37	Il serait temps de faire des espaces pour les chiens car malheureusement on doit enfreindre les règles car nos chiens on besoin de ce dépenser. De ce fait on se fait insulter constamment par les gens qui détestent les chiens. Les gens sont sales les parcs de Lyon 3 sont sales. Je propose que les parce soit autorisés pour les chiens. Ce dispositif existe dans plusieurs villes de France et tout ce passe bien	6/20/2023 12:46 PM
38	Oui, la question des poubelles (tri, récollection avant que tout déborde, etc) me semble essentielle de nos jours, ainsi que l'entretien des toilettes publiques	6/20/2023 11:17 AM
39	Plus d'aires d'ébats pour chien. Très peu nombreux comparé aux espaces pour enfants où les chiens sont interdits.	6/20/2023 7:41 AM
40	N/A	6/19/2023 9:35 PM
41	Perso, j'aime bien le sport, ajoute plus de équipements comme table de ping-pong, barre de traction ça sera superbe	6/19/2023 7:00 PM
42	plus d'arbres dans certains parcs	6/19/2023 5:57 PM
43	proprete	6/19/2023 5:27 PM
44	L'intégration des chiens dans les parcs et non pas les parcs à chiens pour éviter l'exclusion, la peur accrue des chiens et l'augmentation de l'agressivité des chiens de part un endroit clos tels que les parcs à chiens (très mals entretenus par ailleurs) qui augmente le sentiment de protection que peuvent avoir les chiens. Un endroit ouvert à tous favoriserait leur intégration et les chiens seraient inévitablement plus sociaux.	6/19/2023 11:10 AM
45	Trop d'épillets, trop dangereux pour les chiens, il faut les couper !	6/19/2023 9:19 AM
46	Espaces réservés aux chiens !!!! Pour une mairie ecolo et donc respectant la faune et la flore, les chiens sont délaissés. Comment les faire se dépenser en marchant sur du bitume brûlant l'été ? UNE HONTE	6/19/2023 9:03 AM
47	Mieux maitrisé l'impact des évènements organisés dans les espaces verts, en terme de dégradation de l'espace (pelouses, déchets etc…)	6/18/2023 7:47 PM
48	Transférer les animaux du zoo de la tête d'or dans des vrais zoo pour assurer leur bien-être qui n'est pas possible dans un si petit espace	6/18/2023 5:17 PM
49	Entretien régulier	6/18/2023 4:26 PM
50	Plus d'entretien	6/18/2023 4:25 PM
51	Trop de détritus trop de sdf	6/18/2023 11:31 AM
52	Plus d'espaces verts, plus d´arbres	6/18/2023 11:15 AM

53	Beaucoup plus d'arbres, hors espace vert délimité	6/18/2023 10:17 AM
54	Propreté à revoir, plus de poubelles ou passages plus fréquents des cantonniers	6/17/2023 4:07 PM
55	Pouvoir accéder aussi bien avec les enfants qu'avec les chiens	6/17/2023 1:49 PM
56	Oui, accès aux chiens	6/17/2023 10:18 AM
57	Il faut trouver une alternative à la pelouse (qui a tendance à mourir et disparaître avec les températures qui montent et la manque de pluie, laissant la terre nue)	6/17/2023 9:39 AM
58	Un espace pour enfants	6/16/2023 10:29 PM
59	Plus d'arbre pour l'ombre, plus de jeux adaptés à tous les enfants	6/16/2023 5:34 PM
60	Beaucoup plus d'espaces verts et surtout faire en sorte qu'ils soient propres!!! Sans personne qui boive de l'alcool et fume	6/16/2023 5:05 PM
61	Autoriser les chiens partout, au moins tenus en laisse	6/16/2023 2:54 PM
62	Des espaces pour chien	6/16/2023 2:53 PM
63	Autorisation du chien en laisse	6/16/2023 2:40 PM
64	Des parcs à chien	6/16/2023 1:57 PM
65	Autorisation de fréquentation avec un chien en laisse et contrôle de la prolifération des épillets (fauchage et ramassage)	6/16/2023 1:52 PM
66	Accessibilité pour nos amis les chiens	6/16/2023 1:42 PM
67	Trop de détritus trop sale	6/16/2023 9:57 AM
68	Pétanque et banc	6/15/2023 11:07 PM
69	terrain de pétanque	6/15/2023 10:13 PM
70	Terrain de pétanque	6/15/2023 9:59 PM
71	Plus d'espaces vert , une meilleure qualité d'assise pour lire ou flâner.	6/15/2023 2:57 PM
72	Plus de nettoyage	6/15/2023 1:18 PM
73	Plus de parc où les chiens sont autorisés, et aires de jeu canines (Villeurbanne)Plus de jardins partagés et citoyens à Villeurbanne	6/14/2023 7:03 PM
74	Des toilettes	6/14/2023 5:06 PM
75	Tondre moins	6/14/2023 12:43 PM
76	Au moins 1 point d'eau fonctionnel dans chaque parc	6/14/2023 8:41 AM
77	de gros et vieux arbres et moins de déchets ...	6/13/2023 9:40 PM
78	Moins de tags	6/13/2023 2:03 PM
79	Assurer la sécurité en soirée (Feyssine)	6/13/2023 12:57 PM
80	Réparer les jeux pour enfants, les sécuriser et ajouter d'autre jeux ludique	6/13/2023 10:11 AM
81	Plus de poubelles et plus de fontaines.	6/12/2023 8:48 AM
82	La place Bellecour sert à rien : faire un parc absolument !!!	6/12/2023 6:57 AM
83	Accueillir les chiens dans plus de parcs, favoriser la vie en communauté. Les chiens ne disposent que de très peu d'espaces, qui sont ridiculement petits aux vues du nombre croissant d'adoptions. Favoriser la vie en communauté chien + humain dans plus de parcs, ou bien avoir des horaires aménagés auxquels nous maîtres chiens pouvons venir sans se prendre de remarques/amendes.	6/11/2023 11:59 PM
84	Changer le système de verrou des toilettes de tête d'or afin qu'il ne soit pas mécanisé, car si on met un peu de temps on se retrouve à moitié à poil devant la file d'attente ce qui est un peu gênant. Des kiosques de glaces à Blandan et dans les autres gros parcs. Des espaces dédiés aux fleurs également. Des tables de pique-nique avec un vrai dossier quand on s'assoit	6/11/2023 9:30 PM

85	Ouvert aux chiens	6/11/2023 3:50 PM
86	Qu'il y en ait plus	6/11/2023 3:20 PM
87	Un meilleur entretien des espaces verts, plus de nettoyage (déchets, crottes de chien...), coupe de la pelouse.	6/11/2023 3:19 PM
88	Brumisateurs fontaine	6/11/2023 3:09 PM
89	Plus d'espace pour les chiens	6/11/2023 11:32 AM
90	Meilleure accessibilité PMR ; Plus de bancs pour s'asseoir	6/11/2023 10:13 AM
91	Encore plus de vegetalisation et d'îlot de fraîcheur	6/11/2023 10:10 AM
92	Davantage de jeux pour les grands (8 à 12 ans et plus) et des pistes d'apprentissage du vélo	6/10/2023 7:27 PM
93	Manque d'ombre	6/10/2023 6:56 PM
94	Plus d'espace de détente canine et aussi équipés de fontaine à eau	6/10/2023 1:14 PM
95	Espace dédié pour chiens, et également plus de table	6/10/2023 1:12 PM
96	transformer des parkings en nouveaux parcs	6/10/2023 12:27 PM
97	Plus de liberté pour les chiens, de la prévention sur les déjections canines et des sacs à crotte à disposition plutôt que de la répression. Une ouverture vers la nature passe aussi par la réintégration des animaux dans notre quotidien.	6/10/2023 9:59 AM
98	.	6/9/2023 4:52 PM
99	Plus D'espace dédié aux enfants	6/9/2023 4:10 PM
100	Plus d'arbres dans sur les places/ grandes avenues pour plus d'ombre l'été - éviter l'effet four sur le goudron	6/9/2023 1:16 PM
101	Plus de chaises ou de bancs	6/9/2023 10:58 AM
102	Que les chien soient plus acceptés dans les parcs	6/9/2023 7:00 AM
103	Débrouissaillage de tous les épillets un vrai fléau dans certains parcs comme Blandan	6/8/2023 9:32 PM
104	Trop d'espaces auxquels le public n'a pas accès (parterres de fleurs, bassins, etc). Pas assez de jeux enfants, notamment les balançoires	6/8/2023 11:21 AM
105	Plus de poubelles	6/8/2023 10:33 AM
106	Plus d'espaces canins	6/8/2023 7:18 AM
107	plus (+) de toilettes sèches type urinoir car très pratique, plus de poubelles, meilleur entretien des bancs	6/8/2023 12:52 AM
108	Accès pour les espaces pour chiens et de sacs pour ramasser, c'est plus les personnes (adultes et enfants) que son plus sales que les chiens. Chiens en laisse il n'y a très peu des espaces verts pour les chiens.	6/7/2023 6:54 PM
109	Améliorer la propreté, l'ombre.	6/7/2023 10:26 AM
110	Plus de grands arbres pour l ombre et de Verdure	6/6/2023 6:36 PM
111	Des espaces pour les chiens dans l'ensemble des pars.	6/6/2023 5:29 PM
112	Plus de parc/square ou les chiens sont autorisés. Aménager les horaires par exemple : 7h-9h et 19h30-22h chiens autorisé dans les parcs où ils n'étaient pas (car pas d'enfants à ces heures)	6/6/2023 8:10 AM
113	Plus d'espaces accessibles aux enfants et aux chiens en simultané. Des points d'eau et accès à des sanitaires propres et à taille d'enfants	6/5/2023 4:08 PM
114	que les épillets dans les parcs accueillants beaucoup de chiens soient coupés et ramassés !!	6/4/2023 10:36 PM
115	Favoriser les espaces verts pour les chiens.	6/4/2023 7:02 PM
116	Oter supprimer les voitures	6/4/2023 6:45 PM

117	Ou sont les espaces vert pour nos animaux ??? Aucune propreté dans les espaces vert de Lyon poubelle pas assez fréquemment vidées	6/4/2023 6:41 PM
118	L'accexivilité aux chiens. Dans la plupart des villes les chiens sont autorisés, ici non. Nous n'avons pas tous des voitures donc non nous ne pouvons pas tous faire plusieurs km pour aller à Parilly ou Feyssine juste pour pouvoir faire courir notre chien. De plus la plupart des parcs sont squatté par des gens qui deal ou fument. Il y a des débris de verres de partout, des déchets de partout malfré les poubelles a disposition. Les parcs seraient bien plus propre si les chiens étaient autorisés car les maîtres sont consciencieux et ramassent les crottes. Et fonturiner en dehors. De plus la plupart des enfants demandent toujours d'aller voir les chiens. Il faut créer des vrais parcs a chiens pour qu'ils puissent courir et se défouler. Ou au moins des heures où les chiens sont autorisés	6/4/2023 4:23 PM
119	Plus d'accès pour les chiens qui n'ont pratiquement aucun espace vert pour se défouler. Au moins une ouverture alternée le soir dans certains parcs lorsqu'il n'y a pas d'enfant	6/4/2023 11:09 AM
120	Accessible aux chiens	6/4/2023 8:30 AM
121	Beaucoup plus de parcs à chiens (comme celui de la tête d'or)	6/3/2023 10:04 AM
122	Accès aux chiens	6/3/2023 9:20 AM
123	Espace jeux plus adaptés a tous les enfants, c'est à dire Espace foot, cloisonné pour qu'ils puissent jouer sans contrainte	6/3/2023 8:34 AM
124	Espace partagés avec les chiens	6/2/2023 8:40 PM
125	+ de verdure et + d'endroits où se poser	6/2/2023 7:58 PM
126	Qu'il y'ait moins d'herbe grillée.	6/2/2023 5:02 PM
127	Rajouter une place pour jouer au volley-ball l'été	6/2/2023 4:50 PM
128	Attention particulière sur la sécurité (arbres taillés permettant un éclairage des zones de passages sur les places et squares) et un remforcement du contrôle des personnes fréquamment présentes et ce de manière prolongée sur les espaces publics (prévention et lutte contre le développement et persistence des points ou zones de deals ou non-droits)	6/2/2023 2:39 PM
129	Plus de bancs et d'endroits pour se poser au calme et au frais. Plus de fontaines d'eau potable	6/1/2023 5:38 PM
130	Entretien et propreté	6/1/2023 3:36 PM
131	Il faudrait mettre plus de poubelles afin de limiter les dépôts sauvages de déchets. Aussi, certains parcs manquent de zones d'ombre à certains endroits pour les périodes de fortes chaleurs (Parc Blandan, Parc du Vallon...).	6/1/2023 1:53 PM
132	Plus d'espaces avec tonte raisonnée	6/1/2023 1:00 PM
133	Qu'ils soit mieux entrenus. Certains parcs il y a des bouteilles de verres. Donc avec les enfants c'est pas super	6/1/2023 9:21 AM
134	Espace dédié aux chiens :). Sac a crotte disponible dans les parcs	6/1/2023 8:52 AM
135	Oui propretés	6/1/2023 8:31 AM
136	Non juste plus d'espace vert pour oxygéner la ville.	5/31/2023 11:54 PM
137	Ras	5/31/2023 8:27 PM
138	Non	5/31/2023 5:21 PM
139	Plus d'arbres pour se mettre à l'ombre et rafraîchir un peu la ville très bétonnée	5/31/2023 4:14 PM

Question 8 Responses

Q8 Quels autres quartiers de Lyon souhaiteriez-vous voir se développer plus?

Answered: 117 Skipped: 22

#	RESPONSES	DATE
1	Lyon 8, presqu'île	7/3/2023 1:37 PM
2	Lyon 8	7/2/2023 5:59 PM
3	La France en général	6/29/2023 4:35 PM
4	Le 8e, montplaisir, jets d'eau	6/29/2023 10:48 AM
5	villeurbanne n'a vraiment pas assez d'espaces verts et de parc.	6/28/2023 6:07 PM
6	69003	6/28/2023 11:48 AM
7	omg tg	6/27/2023 10:04 PM
8	Vaise	6/27/2023 6:24 PM
9	Villeurbanne	6/27/2023 1:19 PM
10	Dans le 1er et le 2eme	6/27/2023 11:44 AM
11	Lyon 3, Lyon 7	6/27/2023 11:31 AM
12	Villette Paul Bert	6/26/2023 8:01 PM
13	Lyon 4	6/26/2023 6:35 AM
14	3eme	6/25/2023 2:20 PM
15	Aucun commentaire	6/25/2023 11:01 AM
16	Avenue des frères lumière	6/25/2023 10:54 AM
17	Lyon 3	6/25/2023 9:35 AM
18	Tous les quartiers des espaces verts sont très importants	6/25/2023 8:42 AM
19	Villeurbanne	6/24/2023 7:42 PM
20	69001	6/24/2023 5:44 PM
21	Part-Dieu Villette	6/23/2023 7:15 PM
22	Lyon 3	6/23/2023 2:25 PM
23	ne sais pas	6/23/2023 9:32 AM
24	Pas d'avis	6/22/2023 1:30 PM
25	Plus d'espace vert sur les quais du Vieux-Lyon	6/22/2023 12:34 PM
26	Lyon 3 et confluence	6/22/2023 12:10 PM
27	Lyon 3, Lyon 1	6/21/2023 8:02 PM
28	8e 7e	6/21/2023 7:48 PM
29	? Question sans rapport ou mal formulée	6/21/2023 12:45 PM
30	Villeurbanne	6/21/2023 10:27 AM
31	Je ne sais pas	6/21/2023 9:48 AM

32	Lyon	6/20/2023 8:14 PM
33	Le 7e arrondissement près des facs	6/20/2023 4:46 PM
34	Villeurbanne merci	6/20/2023 4:25 PM
35	tout	6/20/2023 4:23 PM
36	Villeurbanne	6/20/2023 4:22 PM
37	Lyon 3	6/20/2023 12:46 PM
38	Les moins favorisés	6/20/2023 11:17 AM
39	Saxe gambetta	6/20/2023 7:41 AM
40	Villeurbanne	6/19/2023 9:35 PM
41	Villeurbanne	6/19/2023 7:00 PM
42	Lyon 3	6/19/2023 5:57 PM
43	69001	6/19/2023 5:27 PM
44	Grand Clément	6/19/2023 11:10 AM
45	Lyon 3 maisons neuves pas assez d'espaces verts et tout est fermé aux chiens. Il faut pénaliser les gens qui ne ramassent pas les crottes avec des contraventions plus dissuasives que 68€ et mettre à disposition du matériel pour le ramassage (sacs, poubelles)	6/19/2023 9:19 AM
46	Pas de préférence mais se concentrer sur les quartiers autres que la presqu'île... je ne comprend pas que personne ne réfléchisse pas à faire comme à Barcelone où toutes les grandes avenues sont arborées et donc la chaleur est plus tolérable !	6/19/2023 9:03 AM
47	Lyon 8	6/18/2023 7:47 PM
48	Lyon 3eme	6/18/2023 5:17 PM
49	Lyon 5	6/18/2023 4:26 PM
50	Le 8eme, le 3eme	6/18/2023 4:25 PM
51	Lyon 8 ème	6/18/2023 11:31 AM
52	Lyon 6	6/18/2023 11:15 AM
53	Part dieu Villeurbanne	6/18/2023 10:17 AM
54	Plus d'informations sur les végétaux	6/17/2023 4:07 PM
55	Villeurbanne	6/17/2023 1:49 PM
56	Villeurbanne	6/17/2023 10:18 AM
57	Je ne comprends pas la question	6/17/2023 9:39 AM
58	Villeurbanne, confluence	6/16/2023 10:29 PM
59	Bir hakeim	6/16/2023 5:34 PM
60	Villeurbanne !!!!!!!!	6/16/2023 5:05 PM
61	Villeurbanne	6/16/2023 2:54 PM
62	La presque île et le 8 eme	6/16/2023 2:53 PM
63	Dauphine lacassagne et Part Dieu Villette	6/16/2023 2:40 PM
64	Lyon	6/16/2023 1:57 PM
65	Lyon 8	6/16/2023 1:52 PM
66	Villeurbanne	6/16/2023 1:42 PM
67	Lyon 8 ème	6/16/2023 9:57 AM

68	Bellecour et presqu'île	6/15/2023 11:07 PM
69	3eme	6/15/2023 10:13 PM
70	Tous	6/15/2023 9:59 PM
71	Villeurbanne	6/15/2023 2:57 PM
72	Lyon vaise	6/15/2023 1:18 PM
73	Ceux de Villeurbanne	6/14/2023 7:03 PM
74	Totem	6/14/2023 5:06 PM
75	Lyon 8	6/14/2023 12:43 PM
76	Le 3e	6/13/2023 9:40 PM
77	Aucun	6/13/2023 2:03 PM
78	La Doua	6/13/2023 12:57 PM
79	Bir hakeim	6/13/2023 10:11 AM
80	Lyon 3, Lyon 7	6/12/2023 8:48 AM
81	Le 2eme	6/12/2023 6:57 AM
82	Presqu'île, dont je suis partie car vraiment pas assez de verdure	6/11/2023 11:59 PM
83	Le 9eme peut-être. Sinon autour de Part Dieu un espace vert un peu + grand	6/11/2023 9:30 PM
84	Le centre ville	6/11/2023 3:19 PM
85	3e	6/11/2023 3:09 PM
86	NSP	6/11/2023 10:13 AM
87	Quartier Part-Dieu	6/11/2023 10:10 AM
88	Croix-Rousse, Guillotière, Duchère	6/10/2023 7:27 PM
89	L'avenue garibaldi pour relier tete d'or et blandan	6/10/2023 6:56 PM
90	Gerland	6/10/2023 1:12 PM
91	Le centre ville	6/10/2023 9:59 AM
92	Lyon 8	6/9/2023 4:52 PM
93	Je ne sais pas	6/9/2023 10:58 AM
94	Le 7eme	6/9/2023 7:00 AM
95	Pas d'avis	6/8/2023 9:32 PM
96	Lyon 7	6/8/2023 7:18 AM
97	69003	6/7/2023 6:54 PM
98	Lyon 3 et 7	6/6/2023 6:36 PM
99	Aucun	6/6/2023 5:29 PM
100	Globalement tous, ils ont tous le même problème lorsque l'on habite pas à proximité d'un grand parc comme Blandan ou Tête d'Or	6/4/2023 10:36 PM
101	Lyon6	6/4/2023 6:45 PM
102	Le 3eme	6/4/2023 6:41 PM
103	Lyon 3 ! Quartier complètement anti chien et parcs salit par les gens...	6/4/2023 4:23 PM
104	3eme arrondissement	6/4/2023 11:09 AM
105	Garibaldi	6/4/2023 8:30 AM

Enquête sur l'état des parcs lyonnais		SurveyMonkey
106	Lyon 3 / Lyon 6	6/3/2023 9:20 AM
107	Lyon 3ème et Lyon 6eme	6/2/2023 7:58 PM
108	Monplaisir/ Grange Blanche	6/2/2023 5:02 PM
109	Le 9eme arrondissement	6/2/2023 4:50 PM
110	9eme, 3eme	6/1/2023 5:38 PM
111	Confluence, le quartier des États-Unis, place Docteurs Mérieux	6/1/2023 1:53 PM
112	Villeurbanne, la guillotière	6/1/2023 1:00 PM
113	Lyon 9	6/1/2023 8:52 AM
114	Guilliotiere nous avont 10 bacs à planté municipaux place du pont derrière le clip entièrement vides depuis 10 ans	6/1/2023 8:31 AM
115	St Fons	5/31/2023 11:54 PM
116	Ras	5/31/2023 8:27 PM
117	3 6 7 2	5/31/2023 4:14 PM

Appendix F – Mapping Results

Mapping Results-PDF