Chapter

Human-Centered Approaches in Urban Analytics and Placemaking

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Abstract

Planning for resilience and enabling positive design outcomes require combinatory methods of working with data, in order to assist decision-makers to develop evidence-based methodologies and to communicate new knowledge. The staggering rise of technology and the integration of data-aided analysis tools in urban planning not only facilitates our understanding of socioeconomic flux but also attempts to actively involve users to participate in the creation of environments that are responsive and appropriate to their needs. This chapter aims to contribute to the discourse on user involvement in design-oriented fields, and specifically in urban planning, by analyzing two different approaches of user participatory design, those of indirect and direct participation.

Keywords: user-centric design, open-data, data-aided analysis, participation, evaluation, 'reblock'

1. Introduction

Planning for resilience and enabling positive design outcomes requires combinatory methods of working with data, in order to assist decision-makers to develop evidence-based methodologies and easily communicated scenarios. To accomplish this, we need to bring together data and information sets from disparate and vastly divergent disciplines and sources. The impactful rise of technology in urban planning has allowed for the extensive integration of data analysis tools, which promote a better understanding of socioeconomic fluctuation, as well as the active involvement of users in the planning process. In this way, users can participate and impact the planning process toward outcomes, which are more appropriate to their needs [1]. Evaluating urban environments is not only important from the planners' perspective but also has larger implications for the residents themselves. This shifts our thinking toward democratic environments, where users engage designers by expressing their preferences on how an idea could become part of their lives. This chapter aims to contribute to the discourse on user involvement in design-oriented fields, in our case, urban planning, by analyzing two different approaches of participatory design. The first approach addresses user participation as a research method or an analysis tool and the second as an urban design method. The key aspect to both approaches is open data platforms, as they allow access to the intended audience, researcher, or average user. Both approaches are presented through example case studies that are analyzed and compared based on the type of user participation, amount of user involvement, and type of context they are applied to. The two case studies represent different stages of participatory design, where the first focuses on the integration of human perspective in neighborhood evaluation and the other on active, contextualized user participation in placemaking and neighborhood reformation. Both processes address human perception as an effective means in capturing the dynamics of space, as well as a mean to drive the change itself. User participation is the agency upon which, local resilience is formed by balancing the power between stakeholders and community members. We support that user-centric approaches improve society well-being and user satisfaction, toward more democratic and sustainable urban environments.

2. Participatory design

In order to improve policy-making and the health of communities, collaborations often extend beyond the level of academic research, to that of the user level. Recent research suggests that researchers create more innovative concepts when taking advantage of user input than working purely with existing data sets. Humans are positioned as the major contributors to changing environments [2]; therefore, human factor should be addressed and included when conceptualizing urban analysis methodologies. This approach has a political dimension of user empowerment and democratization, and it is called participatory design approach. Participatory approaches link together all stakeholders (e.g. employees, researchers, customers, citizens, end users), in an attempt to improve human well-being, user satisfaction, accessibility, sustainability, and livability. As participatory processes are more and more supported by information technology, this enables both sides, users, and researches to understand and collect diverse knowledge, for example, opinions, ideas, objectives, statements, etc.; however, it increases the complexity and the handling of information when it comes to decision-making. Regarding user participation, the possibilities of digitalization should be regarded as an opportunity to accompany the social transformation toward a digital society in the information age of the twenty-first century [3]. A participatory process involves the side of the researcher or organizer and the side of the participants. In this chapter, we present two different directions of the above relationship: indirect user participation and direct user participation. In the first case, the users seek no personal interest in the process; however, they state their opinion regarding a real matter, which is proven useful in understanding urban dynamics. This process involves two stages that depict different processes. The results are then combined in a series of maps. The second case is a deliberate process in which the interested party (citizens) is involved in the policy-making toward the satisfaction of their needs. The process involves the construction of a digital platform that is user driven. This approach builds upon participatory action research by moving beyond participants' involvement and producing solutions to problems rather than documenting the results as a resource database. Further stages may then focus on community brainstorming, modeling and prototyping, and implementation in community spaces.

3. Challenges of central urbanism methodologies

Urbanism during the twentieth and beginning of twenty-first century was formed by large-scale centrally planned developments. In the 1960s until early 2000s, several urban analytics models incorporated computational tools that introduced automation and standardization, in order to visualize and understand the urban space. One of the most widespread used tools that revolutionized mapping since the 1960s was geographic information system (GIS), which enabled the association of geo-location with information. GIS systems are able to visualize time and space paths as static models using models of space and time that show the entire path within a geographic space and a fixed domain of time [4]. This has greatly lowered the cost of data accumulation and improved the accuracy of the results [5]. The main data source employed in central urban model is census data from government databases, which with the use of GIS tools can be visualized and mapped.

Central urbanism presents certain challenges, which derive from two sources: the first is related with technical aspects of data sets and data handling and the second with socioeconomical aspects that influence the fluctuation of capital and investments related to urban space and infrastructure.

1. Centrally planned urbanism refers mainly to the broad picture of the urban environment; as a result, it does not address local details adequately. Centralized, top-down approaches do not derive in resilient conditions as they usually favor certain economic interests. In contradiction to bottom-up approaches, central-based urbanism does not rely on evidence-based methodologies, and therefore they do not involve user participation.

2. In addition to the above, centralized approaches involve money-oriented developments, which do not respond to local citizens' needs; in fact, they usually undermine them. As they largely follow the dictates of social and economic elites, they are based around uneven development and exclusion, increasing economic segregation.

3. Centrally planned urbanism is based on limited data sets and assumptions, which fail to address cities as arrays of social complex relations. Such assumptions engendered vehicular domination over walkability, maximized urban density, and homogenized urban districts all at the expense of residents' quality of life. It appears that there is hardly any empirical data or residents' input that provide insight into most central-based master plan developments. Central urban models are guided by a set of specified constraints that perform in a simplified environment disconnected from real facts; thus, they may not capture complex dynamics of socioeconomic flux. One explanation for this is the difficulty of adequately incorporating the breadth of social theory needed to account for the range of urban mechanisms. For instance, even the analysis of the relationships that occur in a park of a business district neighborhood during day and nighttime quickly becomes a complicated problem to describe through census data. These models are constrained by their inability to theoretically ground mechanisms of neighborhood change and translate them into a data set. They are limited by a lack of empirical detail, in their specifications of data attributes.

The challenges listed above derive from the fact that the processes employed mask a great deal of heterogeneity between urban areas. This resulted from deficiencies in the data sets and short time-scale of the analysis, factors that designated the low predictive capacity of the models, and the insufficiency to fully understand neighborhood dynamics, which remain ambiguous and conflicting.

As cities are becoming more instrumented and networked, more data is being generated about the urban environment and its residents, allowing urban designers to access the local scale fabric of the city, opening up new research directions for understanding the city. Going beyond traditional data sources, such as census, which is fairly static and updated only every, designers are encouraged to engage with other types of data that capture the ephemeral side, such as, people's desires, problematic, trends, etc. It is important for designers and planners to recognize the opportunities for making better sense of public space through technology. One of the key benefits of adopting a data-driven approach to urban analytics surveys is the ability to see a combination of datasets in context with each other and to detect temporal and spatial patterns.

4. Challenges of participatory design

A new generation of researchers has been deriving evidence-based rules for urbanism, which benefits from user participation [6]. These rules replace outdated working assumptions that have created dysfunctional urban conditions. Recent methodologies in urban research validate human scale urbanism and collaborative approaches. In order to provide a better understanding of the contradictory approaches, we will list some of the main challenges of centralized urbanism. Moving beyond the form-oriented framework of centrally based urbanism, we should also refer to certain challenges that the participatory approach entails.

The growing desire of involving participants in the process represents certain challenges that need to be addressed for successful decision-making [7]. Building user participation systems in response to the complexity requires a combination of data, which is fit for use and decision support tools. We list some of the key barriers that are present in user participation approaches.

1. Complex data user inputs. User data inputs are usually complicated data types. For example, natural language text, descriptions, sketches are a challenge for computers to interpret and also for researchers to translate them into a binary or measurable form. This type of data is also difficult to store, categorize, and visualize in a proper way for future interpretation.

2. The translation of miscellaneous forms of data input is a labor intense, manual analysis and might result in potentially obscuring part of knowledge that can be drawn from the raw user data.

3. Ensuring that the user understands the request and is able to provide useful feedback. Abstract requests could result in user distraction, which can complicate the feedback data previously described in the first point. Moreover, researchers will need to consider that the user input should not rely heavily on the users technical skills and prior knowledge of the tools, as this would limit the target user group to a very small pool of people, which would have the expertise.

4. Citizens are often a resource of small-scale ideas that could improve the livability of their immediate environment. However, it is hard for local people to coordinate and produce visualized results that they could communicate with the authorities. Even so, such proposals are likely to be discarded as they do not represent the stakeholders' benefits and moreover, large-scale developers make it impossible for citizens to have any influence in urban development.

Based on the above, opening a channel for sharing knowledge and opinions is not necessarily sufficient for building a system that takes the most advantage of user input. The objective is to achieve a balanced relationship between extensive information and clarity, in order to ensure that all the data and their interconnections are handled to their entirety. We need to build human-computer interaction in a way that it facilitates user orientation and comprehension of the framework, defines the scopes of the user and the researcher, and translates the user input into a quantifiable entity. Therefore, we refer to a software workflow/application that ingrates user input in a form of binary data that can be easily quantified, categorized, and visualized. To avoid oversimplification of the process, the insight of the researcher is crucial, in order to extract valuable, subjective information in a simple format.

5. Case study 1: urban analytics through crowdsourcing methodologies

5.1 Introduction

The first example is a mapping process of the gentrification and displacement rate and livability levels in the neighborhoods of Oakland in the San Francisco Bay Area. Before analyzing the methodology of the example, we should first understand the notions of neighborhood and gentrification as addressed in this chapter, which will provide clarity regarding the reasoning behind the example methodology.

The neighborhood is often understood as the physical building block of the city for both social and political organization [8] and thus combines physical and nonphysical characteristics. Early scholars have described neighborhoods as defined, closed ecosystems, characterized only by their physical elements, such as size, density, demographics, etc. that would get disrupted by external factors, such as new residents. Moreover, neighborhood change has been regarded as a natural process of population relocation and competition for space, until a state of equilibrium could be reestablished. Based on these ideas, neighborhoods were presented as a deterministic model and categorized based on simplified criteria such as their residents' financial status, etc. However, neighborhoods are not introverted, autonomous clusters, and the mechanisms of neighborhood change do not rely on exclusively external factors. According to Jacobs [1], nowadays, people identify a neighborhood by a landmark in the city because it has become intimate from daily use or encounter. The key that creates the notion of a neighborhood is diversity and identity. She argues that people tend to avoid visiting places that do not represent any variation either in function or esthetics [1]. Although the modern way of living has urged people to be more mobile than previously, people tend to pay attention to district that surrounds their home if it meets the certain criteria that fit their lifestyle. The stability of a neighborhood relies on its capacity to absorb opportunities and sustain its diverse character. In this paper, the term neighborhood can be described as an instance of organized complexity [1].

The notion of gentrification can be described as one category of neighborhood change and is broadly defined as the process of improving and renovating previously deteriorated neighborhoods by the middle or upper class, often by displacing low-income families and small businesses. The first documented use of the term "gentrification" [9] describes the influx of a "gentry" in lower income neighborhoods. Owens identifies nine different types of neighborhoods that are experiencing upgrading: minority urban neighborhoods, affluent neighborhoods, diverse urban neighborhoods, no population neighborhoods, new white suburbs, upper middle-class white suburbs, booming suburbs, and Hispanic enclave neighborhoods [10]. Gentrification does not only rely on a singular cause, as it may emerge when more than one condition is present. It is a complicated process that does not rely on binary and linear explanations. Early studies identified two main categories that cause gentrification: private capital investment for profit-seeking and people flow that refers to individual lifestyle preferences [11]. Gentrification does not necessarily result in negative effects, as it can also operate as a tool for revitalization. When revitalization occurs from existing residents, who seek to improve their neighborhood conditions, the result can be constructive in enforcing the neighborhood stability. This condition is called incumbent upgrading or "unslumming' as Jacobs [1] defines it. However, when revitalization causes the displacement of current residents and a decline in neighborhood diversity, then neighborhoods gradually become segregated by income, due in part to macrolevel increases in income inequality as well as decline of job opportunities. Hence, neighborhood stability is compromised because the opportunities have been narrowed down to a very limited range of financial status and lifestyle. Displacement, however, is identified as the biggest negative impact of concern resulting from neighborhood revitalization and gentrification. Displacement occurs when any household is forced to move from its residence, usually because of eviction and unaffordable rent increase [12]. However, tracking unwilling displacement can be challenging to categorize, as researchers have faced limitations regarding data availability and data comprehension.

In this case study, we carefully selected and analyzed the various, specific data sets that relate to gentrification and are associated with livability, from authoritative census data categories, such as income, crime, education level, employment rate, urban infrastructure, etc. to more ephemeral and subjective data classifications related to human perception and user input. In order to go beyond the conventions in understanding the dynamics that drive socioeconomic phenomena and construct lived space, we attempted to implement methods that although they are considered disassociated with urban analytics, they offer a strong potential in contributing to this study as it will be analyzed in detail in the following paragraphs.

This case study involves three methods of data accumulation and analysis; the first method is a preliminary census data classification of key GIS data sets that are available from the government and other certified public resources. The second method uses data resources that derive from open data platforms (data that is freely accessible), such as Google API, Google Places, and collective, open-data platforms where users post all kinds of requests (sell and buy, real estate, etc.), such as "craigslist.org", while the third uses human perception and subjectivity as a qualitative source of data that can unveil qualities that could not appear otherwise and enrich the outcome with a diverse layer of data. This enrichment leads to a more informed decision-making and a more qualitative image of the city that reflects subjective aspects of urban planning [13].

Although the methods differ significantly in the types and source of data being used, it is important to mention that each perspective provides a different lens through which to view transition toward more or less livable and gentrified environments. The data sets collected from the three methods operate at different scales, some at urban scale for the entire San Francisco Bay Area, some at neighborhood scale, and some at street level scale. Each method presents certain advantages and altogether provide a calibrated understanding of the multiple grains of constructed space through top-down and bottom-up methods, as well as to offer a tool of visualizing dynamical characteristics of the urban environment. For example, using a human-based perspective alone may lead us to commit to something, which is entirely subjective, by ignoring holistic factors that emerge at aggregate levels and vice versa. The census data analysis provides an overview of the context over a significant time span (2000–2012) and helps us understand major socioeconomic shifts that affect tenure, which then affects the local market and the standards of living in the area in terms of public infrastructure. The open data analysis depicts the ephemeral layer of relationships that take place in the urban environment, which is impossible to be described by authoritative data; however, it is more relevant to the actual conditions, revealing virtual changes and dynamics for the near future. The third method enriches the process with user personal feedback about ranking the environment of a neighborhood as it currently stands.

Across all three studies, the data has been visualized based on a few basic rules. Changes of degree in a factor are displayed with a gradient of the same color, changes of type are displayed with different colors, and the general vocabulary of visual styles is communicated with dots, lines, and areas [14]. The tools used for the data visualization are "Microsoft Excel" for calculation of delta, median, and average values, "Grasshopper" for processing data input in ".json," ".csv," or ".shp" file formats, "Rhinoceros" for processing the output data from "Grasshopper," "Processing" as a geo-located three-dimensional virtual space, where multiple data sets can be displayed and overlaid at the same time, in order to assess their relationship and "Adobe Suite" for final printed output.

5.2 Method 1: preliminary census data analysis

The initial method, which defines the preliminary step of the research, refers to the use of GIS census data analytics. This method aims to depict the urban areas that have undergone changes on authoritative parameters that are associated with the phenomenon of gentrification, such as tenure status, median household income, land value, and employment rate. Moreover, this method queries the livability levels based on parameters related to public infrastructure and the urban quality, such as pedestrian network continuity and status, transportation, walkability, and car dependency street trees and parks, schools, education points, medical and religious spaces. The objective of these data sets integration is to assess whether the built environment is evolving toward an equal state of services and other opportunities or in favor of certain socioeconomic groups over others.

The "Geographic Information System", or GIS, tools enable the accelerated gathering of data sets of multiple categories. As this method focuses solely on census data and basic population characteristics, the data sets that are useful to the execution of the survey are population, median household income, level of education, transport network, and infrastructure.

Initially, the survey began with a high-level analysis of the San Francisco Bay Area natural morphology and broad population characteristics; therefore, the first data sets that were visualized were green areas, wetlands, urban areas, total population, and land value (**Figure 1**). Before analyzing more thoroughly the city of San Francisco, we collected some data related to the homeless population community in the city as it is a very apparent phenomenon that appears to be getting aggravated. As the core of the research is focused on depicting and tracing the dynamics of gentrification, we believe that information associated with the homeless population community and then compared with the census data regarding tenure status and land value could provide useful insight (**Figure 1**).

The second stage of the survey focused solely in the county of San Francisco, as it was considered a suitable context to trace the main changes in demographic characteristics. The data sets that were visualized at this stage of the survey were the range of household income, range of home value, owner-occupied housing, vacant lots, and the ratio of unemployed population against the total population (**Figure 2**). Green areas in the San Francisco Bay Area that are accessible to the public, such as parks, plazas, etc, were excluded from the calculation as they do not relate to the targeted data sets, and they would have affected the results of the survey.

Although the previously described survey did reveal information on the transition of some neighborhoods in San Francisco, at the next stage of the research, it became apparent that the most applicable scale for census data display would be that of the entire San Francisco Bay Area. The reason for this is that census data has low spatial resolution and therefore refers to large-scale surveys. Hence, the data was recollected for the San Francisco Bay. The census data collected consists of data sets that range

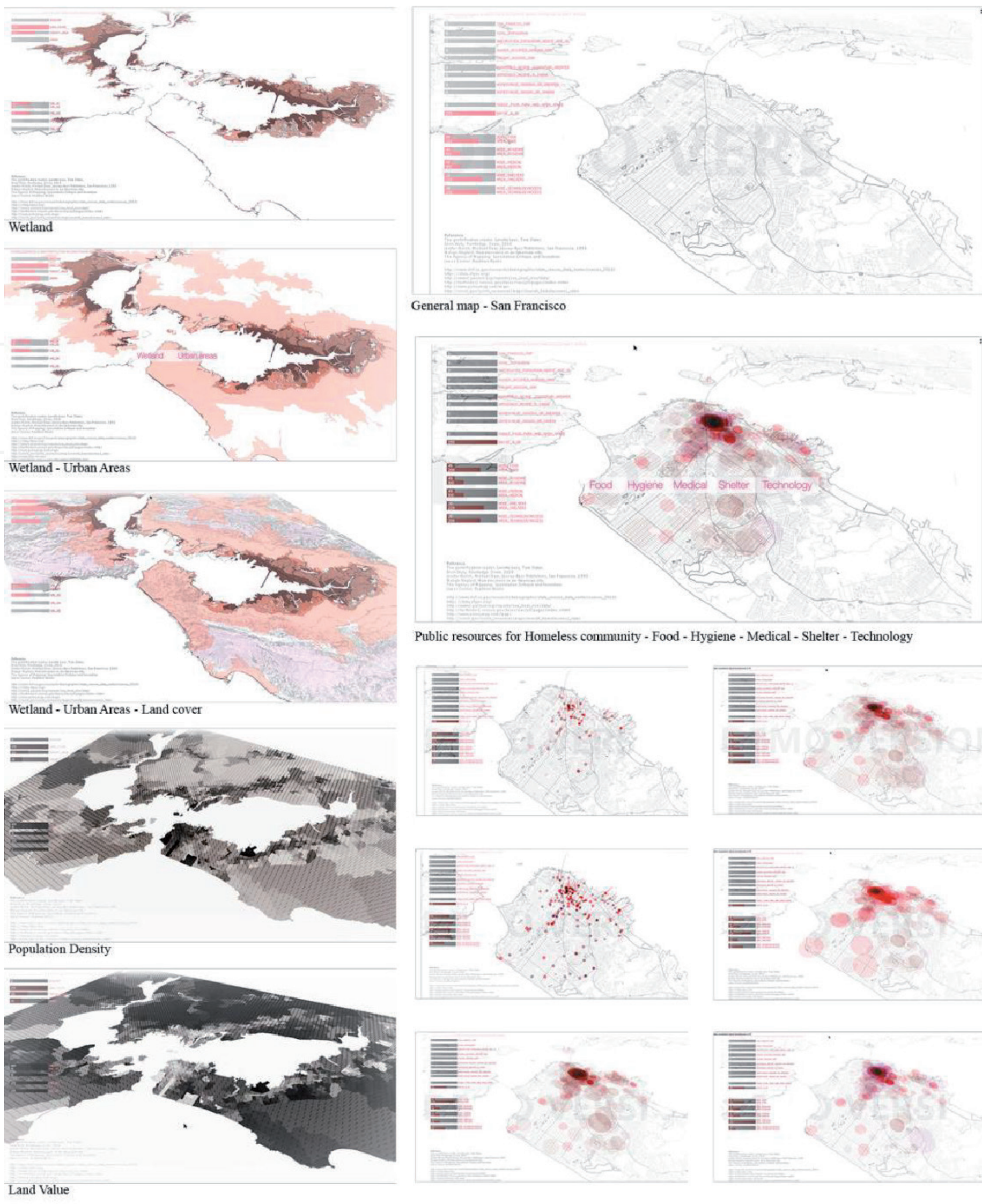

Figure 1.
Geo-located 3D space in the software processing. Natural elements and census data for San Francisco Bay Area. Public resources for homeless population for the city of San Francisco (figure was created by the author) [20, 21, 22].

from 2000 to 2012 and is related to tenure status, median household income, median home value, and employment rate. For every data set of the above, we calculated the delta value (amount of change or difference) between the years 2000 and 2012 and remapped the values to a numerical range between 0 and 1, which corresponded to a gray scale ranges from white (255, 255, 255) to black (0, 0, 0). White color represents no change, whereas black color represents the highest amount of change. The delta value was plotted in the context of San Francisco Bay Area, and the result is four maps, each for one data set. The four maps, which derived from the process described above, represent the amount of change in tenure, median household income, median home value, and employment rate were weighted and integrated into a single map that represents the amount of change of all four data sets (**Figure 3**).

In addition to the data sets related to tenure status, we included the census data of artists' employment rate as it is considered a key indicator of the early stages of a gentrification process. Surveys in the field of urban renovation have established

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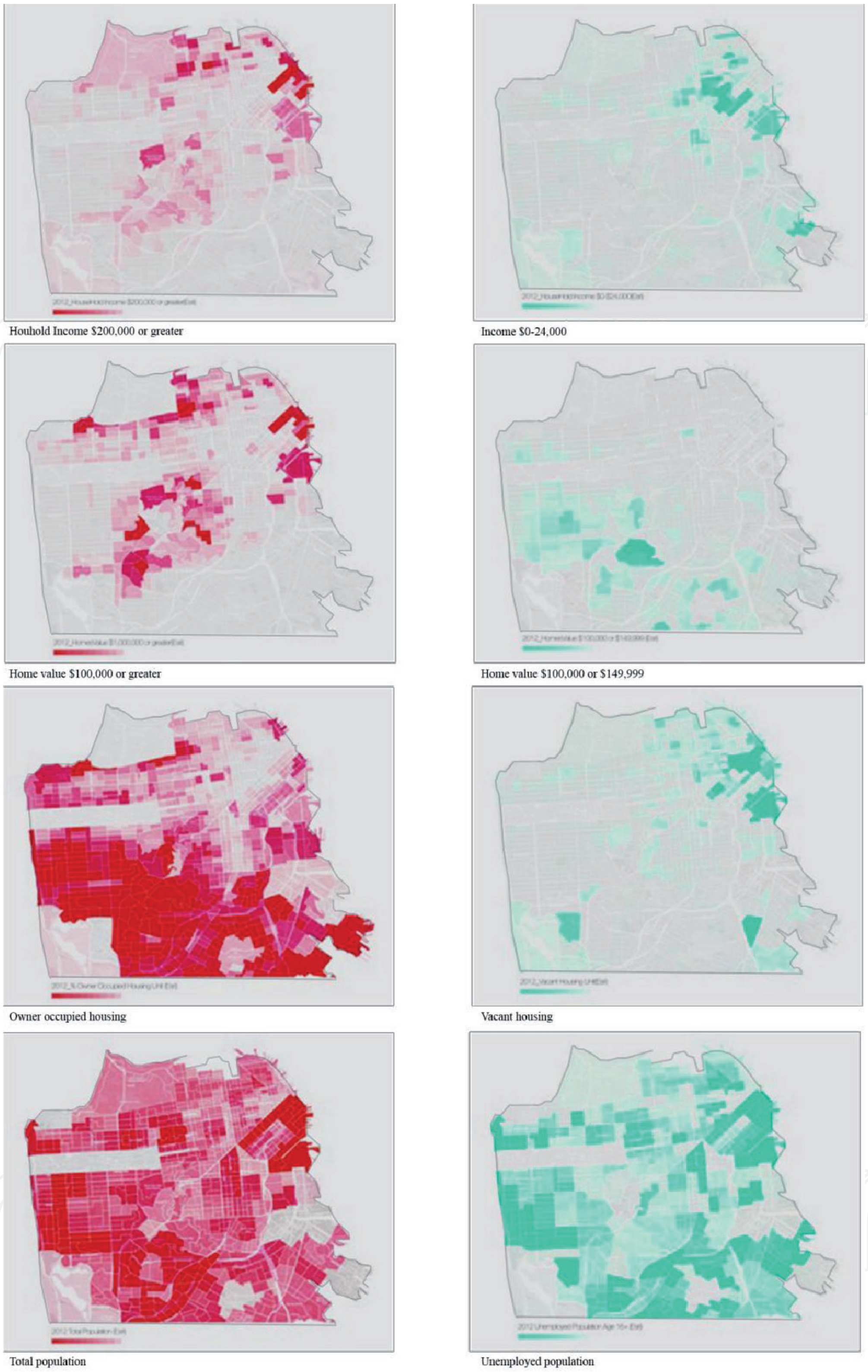

Figure 2.
Census data for the city of San Francisco, total population, income, vacant housing, home value, unemployed population (figure was created by the author) [18].

the artists community as an agent of urban gentrification, for the reason that low-income artists tend to revalorize unproductive spaces because they are affordable and, as a result, increase the attractiveness of the neighborhood. Artists make the first move into post-industrial, post-welfare neighborhoods, and soon they attract the hipster movement before, eventually, being displaced by them and their new middle-class neighbors. Both participate in the cycle of exploring, developing

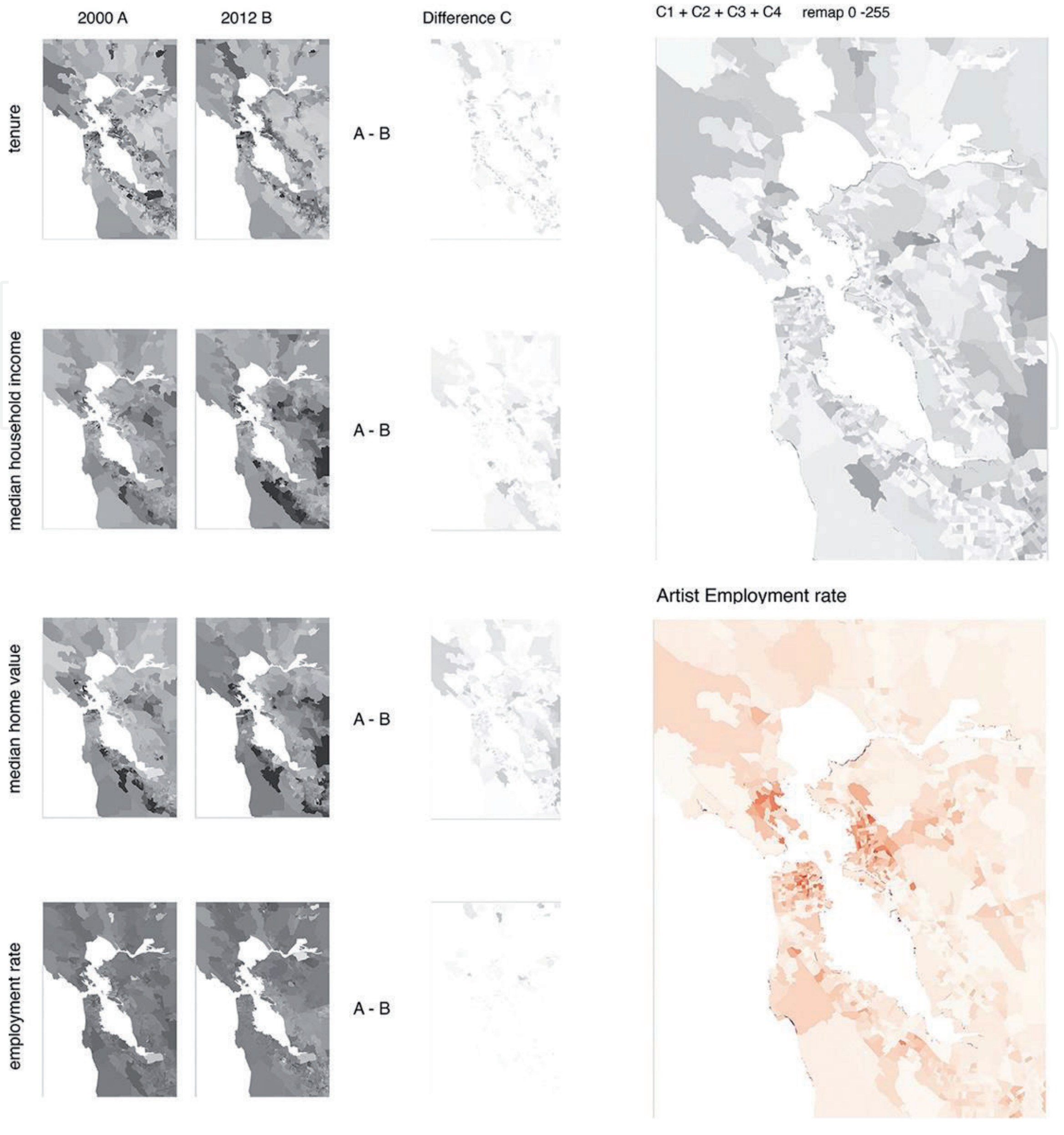

Figure 3.
San Francisco Bay Area, census GIS data comparison of tenure, median household income, median home value, and employment rate from 2000 to 2012 overlapped with artists' employment rate (figure was created by the author) [19, 20, 22].

new potential sites for capital investment. Hence, the combined data set of the four census categories is overlapped with artists' employment rate census data set (**Figure 4**). Regarding the services that are directly related to the urban quality, such as accidents and pedestrian network continuity and status, transportation, walkability, and car dependency street trees and parks, schools, education points, medical and religious spaces, the data sets are divided in two categories. The first depicts amenities such as access to education, religion, health, and green areas, as well as the street trees that definitely improve the urban environment in terms of walkability, microclimate, and aesthetic. The second depicts car dependency zones, reported car injuries location, pavement condition, and parking spaces (**Figures 5**–**7**). The source of the data sets mentioned above was mainly government websites, and the data were provided in.csv format. Data were imported to Microsoft Excel, in order to calculate and process the key indicators that derive from more than one data set and the delta values from the comparison of the data set over a period of time. After the calculation, the information was then imported in grasshopper and processing for visualization in context, as a series of maps.

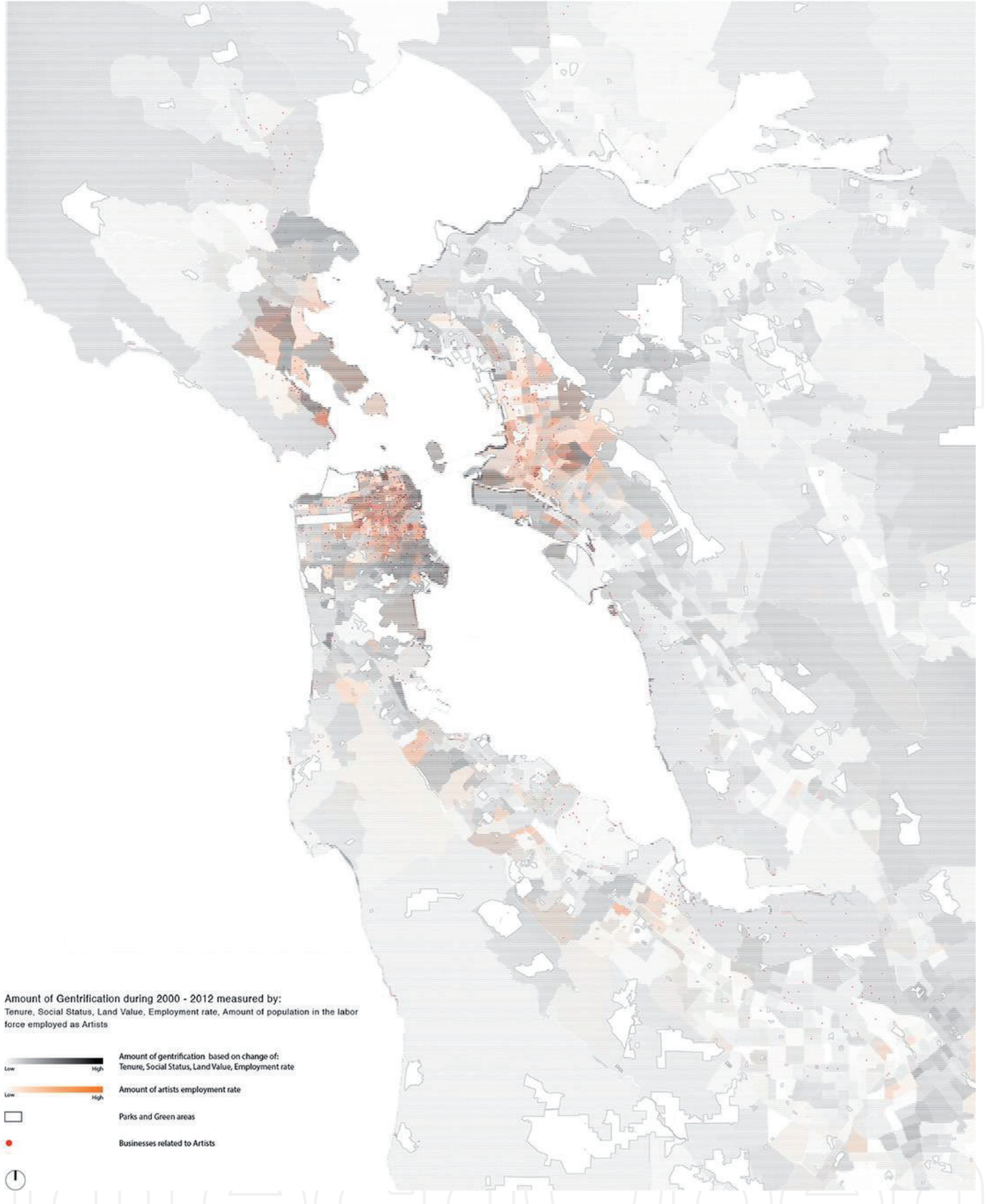

Figure 4.
San Francisco Bay Area, census GIS data comparison from 2000 to 2012 overlapped with businesses related to artists from Google places (figure was created by the author) [19, 20, 22].

5.3 Method 2: open-data

The database is articulated by tracing certain populations and services categories that reflect activity and flux of the built environment. The targeted data sets involve artists and their recent activity in Oakland, industrial buildings, loft residencies, yoga and fitness studios, fashionable cafes, as well as crime reports from 2010 to 2013 (**Figures 8** and **9**). The data accumulation derives from open data platforms by defining an equivalent keyword query. The artist population is considered as the frontline of gentrification [2]; therefore, tracing their activity would provide useful insight, combined with a survey on loft residencies, which usually attract the artist community and on certain amenities that appeal to the same target group. The survey on industrial buildings helps in the formation of a forecast model of potential

Figure 5.
Oakland green areas, street trees, transport, and education (figure was created by the author) [17].

transformation of industrial building envelopes to loft residencies. The chosen data sets describe adequately the artists community in the sense that it is commonly known that upcoming artists are mostly freelancers or seeking for a job, and in order to settle their studio, exhibition space, etc, they actively pursue real state, as well as specific lifestyle preferences. This activity regarding real estate hunting cannot be described by census data, simply because it is volatile and constantly shifting. Methods that employ open data platforms such as Google Places and "craigslist.org," however, can capture the activity of such groups very accurately as every activity is geo-located. The key difference between the census data analysis and this method is that the data derives from open-data platforms by defining a key word query. Despite the fact that the two methods are referring to the same target group, in this case, artists, the data are a result of a significantly different process and source. The open-data method, using Google API and "craigslist.org," involved multiple requests at a daily basis, in order to collect all the necessary data. The keyword queries were related to temporal

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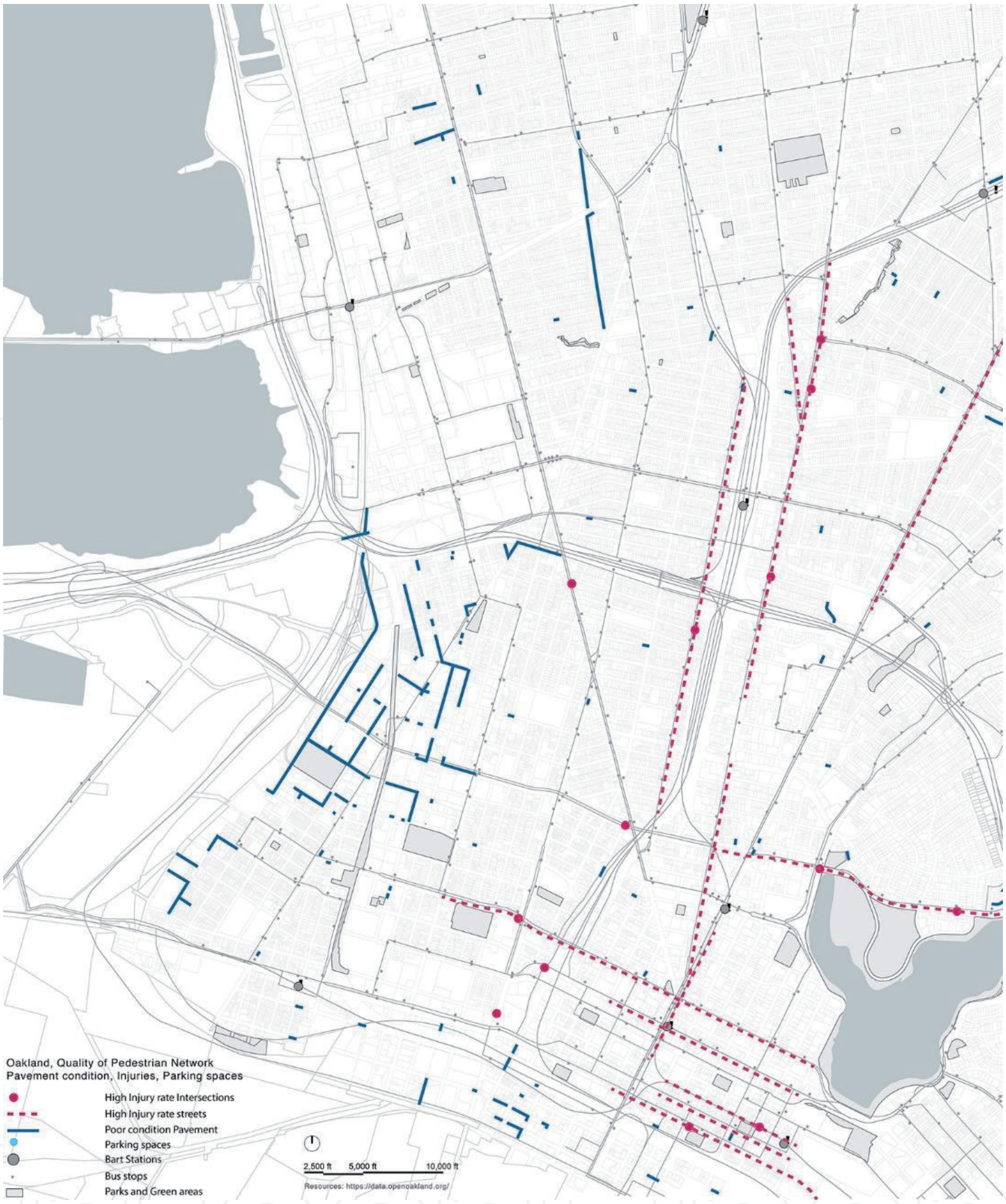

Figure 6.
Oakland, quality of pedestrian network, pavement condition, injuries, and parking spaces (figure was created by the author) [17].

requests and offers regarding real estate for artists' studios, gallery spaces, events, artists' resources, artwork sale, exhibitions, FAQ, etc. The second set includes crime reports posted from civilians for the years 2010 and 2013, depicting a significant decrease in reported crimes during that period. The data accumulated was formatted in.csv format and visualized as nodes on the same context (**Figures 8** and **10**).

5.4 Method 3: crowdsourcing

The second method involves a human-based approach, as a crowdsourcing process. In this method, the crowdsourcing process was achieved via a human-based outsourcing platform called "Amazon Mechanical Turk." The "Amazon Mechanical Turk" platform is a crowdsourcing Internet marketplace, operated by "Amazon," which enables individuals to coordinate the use of human intelligence and perform

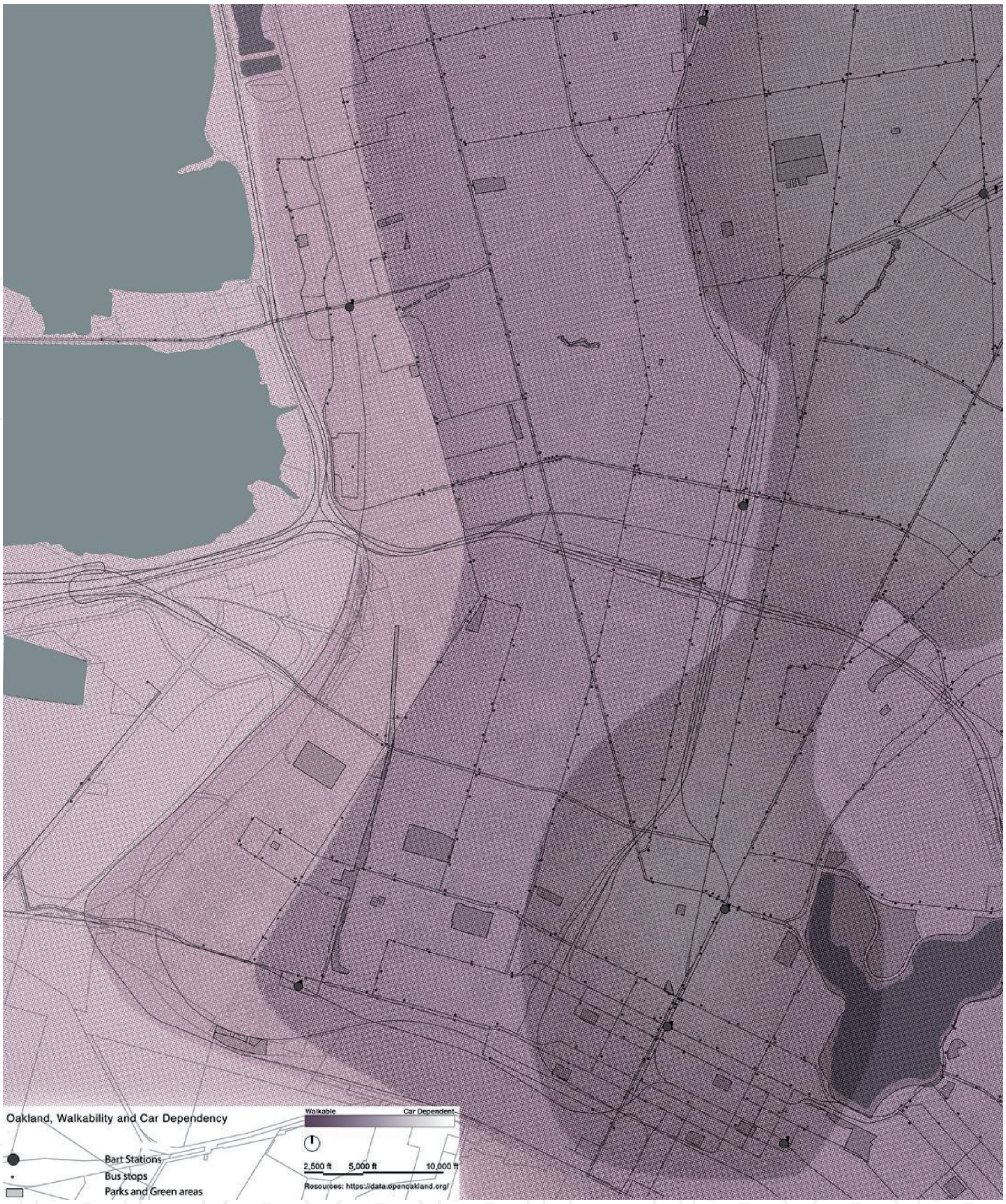

Figure 7.
Oakland, walkability, and car dependency (figure was created by the author) [17].

tasks that computers are currently unable to perform successfully. It is an on-demand sample of users that executes simple assignments over an agreed period of time. The "Amazon Mechanical Turk" can be associated with the term "Human Computing."

Initially, and in order to test the feasibility of this method, we processed only few blocks in Emeryville, Oakland, and the questions posted to Amazon Mechanical Turk were very simple and required identification of certain elements and whether they appear in the images. Example elements that were queried are bicycles, lofts, abandoned buildings, and industrial buildings (**Figure 11**). In the next stage, a large group was given two different sets of questions. The first set of questions is related to human subjectivity, which implies that the users were given a set of subjective questions that were related to the qualitative rating of selected neighborhoods in the San Francisco Bay Area. The questions were communicated in a simple way, by extracting Google Street viewpoints as images and submitting

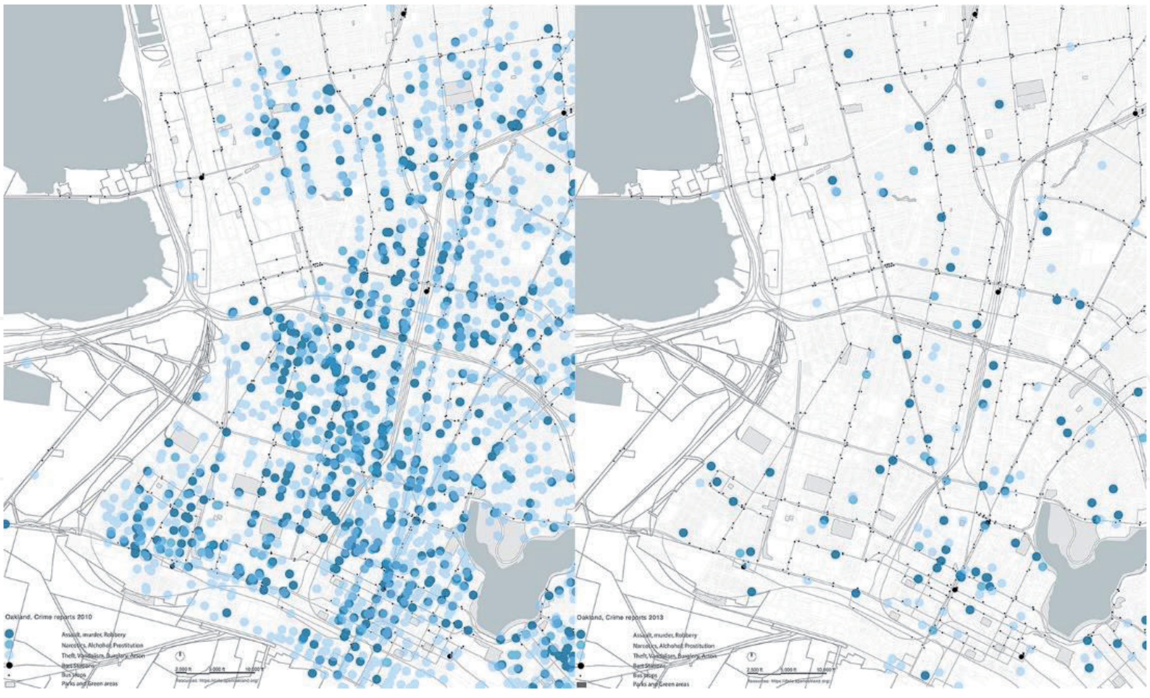

Figure 8.
Oakland crime reports, 2010 (left), Oakland crime reports 2013 (right) (figure was created by the author) [23].

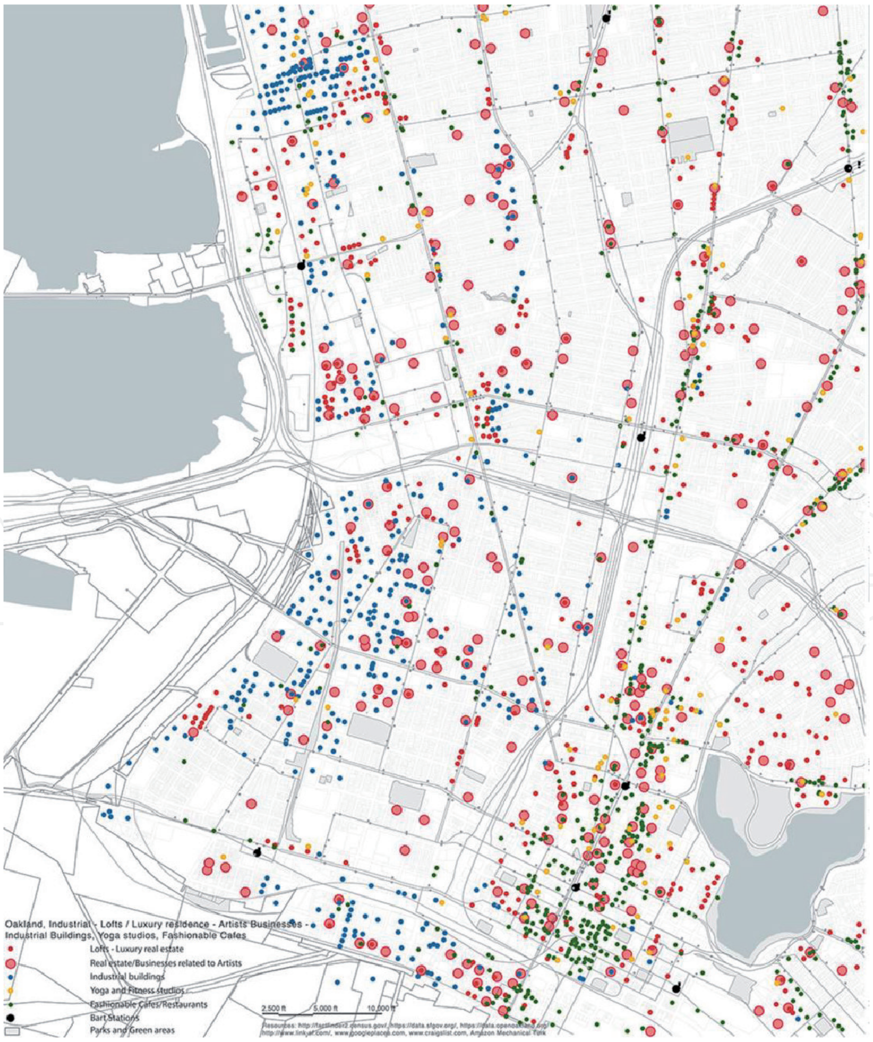

Figure 9.
Oakland, industrial buildings, lofts/luxury residence, businesses related to artists, yoga and fitness studios, fashionable cafes (figure was created by the author) [23–25].

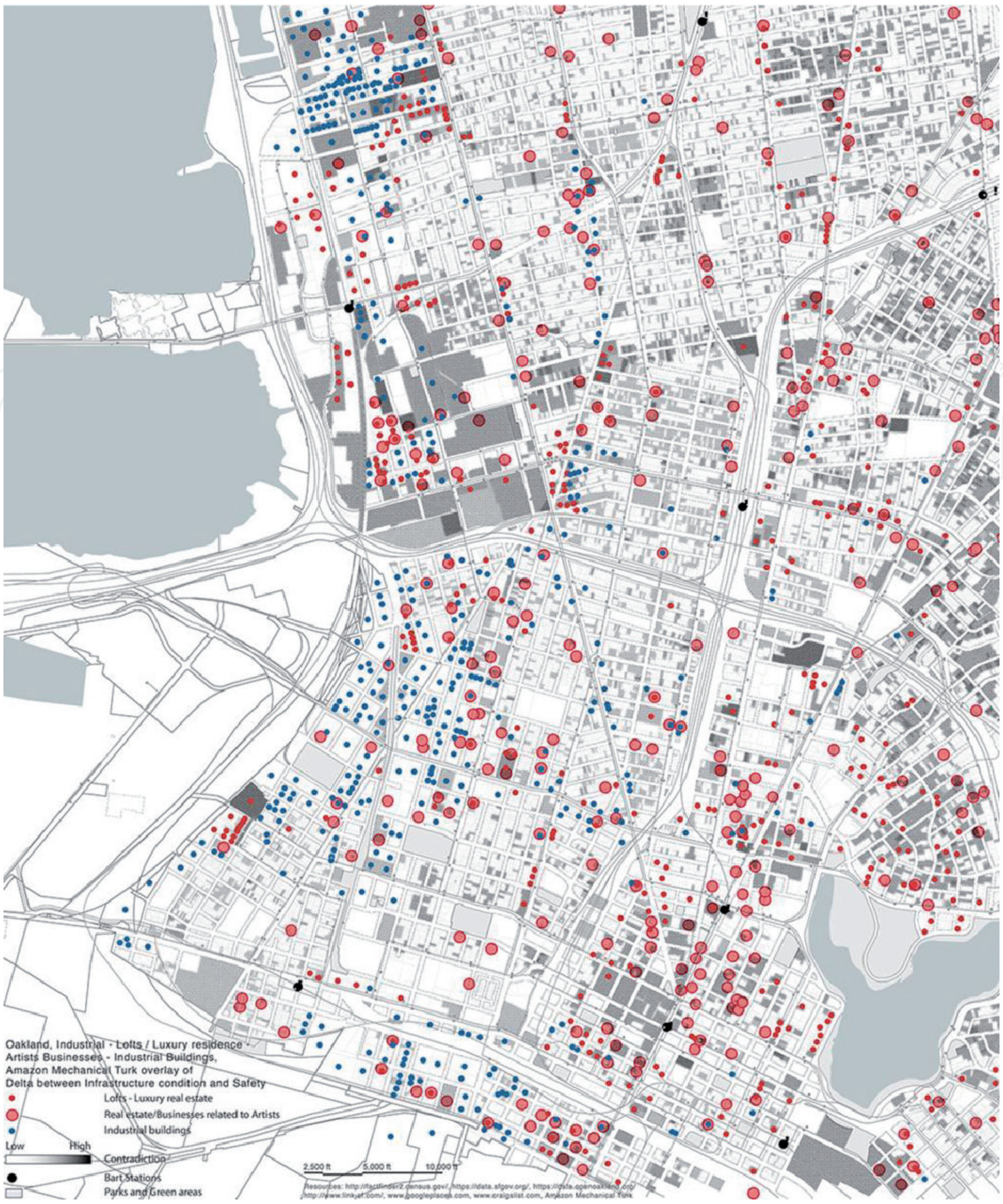

Figure 10.
Oakland, industrial buildings, lofts/luxury residence, businesses related to artists overlaid with Amazon Mechanical Turk Delta between infrastructure condition and safety (figure was created by the author) [23, 25].

Figure 11.
Amazon Mechanical Turk Oakland example maps of bicycles, lofts, abandoned buildings, and industrial buildings (figure was created by the author).

them to the "Amazon Mechanical Turk" system for rating along with a series of questions regarding the content shown in the images. This process takes advantage of human subjectivity when it comes to rating an area based on someone's personal

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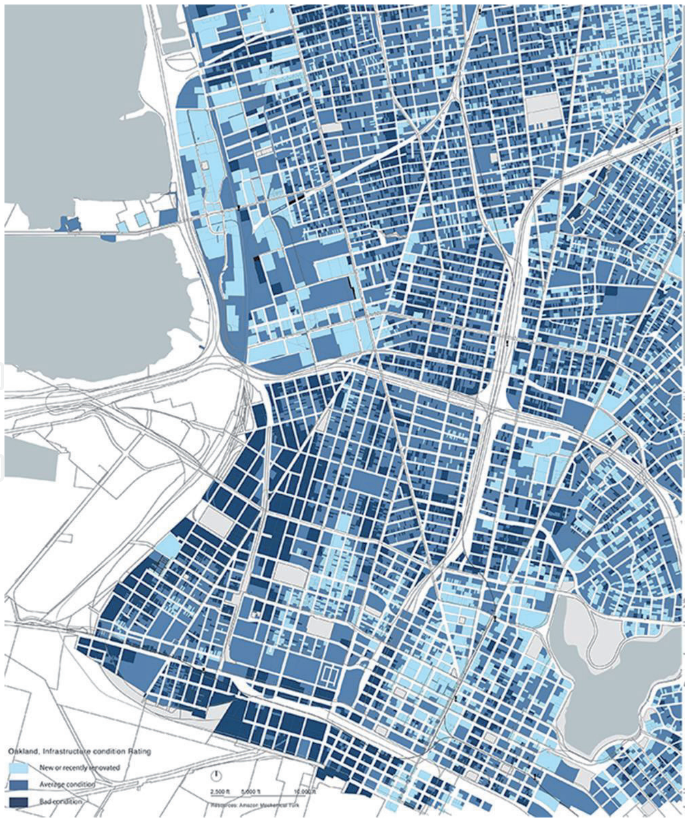

Figure 12.
Amazon Mechanical Turk neighborhood rating: neighborhood infrastructure evaluation (figure was created by the author) [25].

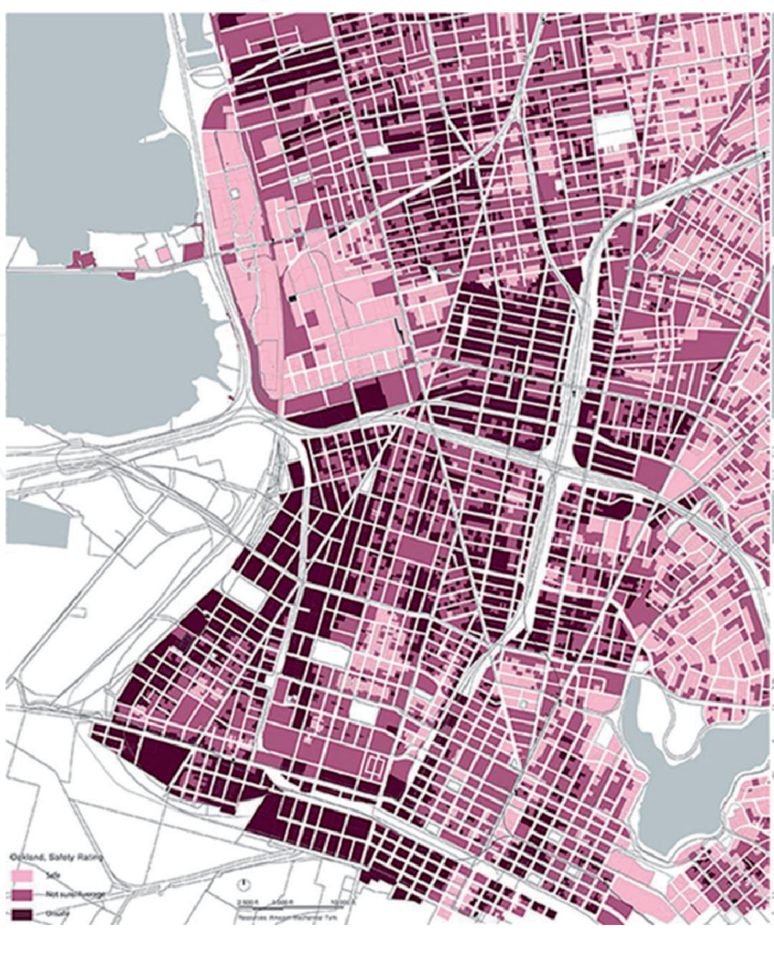

Figure 13.
Amazon Mechanical Turk neighborhood rating: neighborhood safety evaluation (figure was created by the author) [25].

infrastructure condition (**Figure 12**), interpretation of safety (**Figure 13**) and affordability (**Figure 14**), qualities that vary significantly even among neighboring blocks; however, the amount or the frequency of variation may have a significant role in the overall research. The second set of questions is related to the collection of detail features, such as the presence of expensive loft housing, abandoned buildings, industrial buildings, trees, fitness studios, contemporary and stylish coffee shops. This process is utilizing the same strategy as the first one, by using Google Street viewpoints in order for the participants to identify the presence of any of the feature elements in the content of the images. The identification of these features would be extremely time consuming to collect manually; therefore, this method is proven highly efficient on this aspect. The areas of interest for both sets of questionnaires are Oakland and Emeryville, which were chosen because they are transforming from high concentrated crime areas into urban, entertainment, and commercial attractor points. The questions were submitted to "Amazon Mechanical Turk" as a file in ".json" format and were structured in a way that the answers would be easy to process and to visualize. In particular, the answers to the question would have to be represented either as a numerical scale from 1 to 10, as a binary yes or no option, or

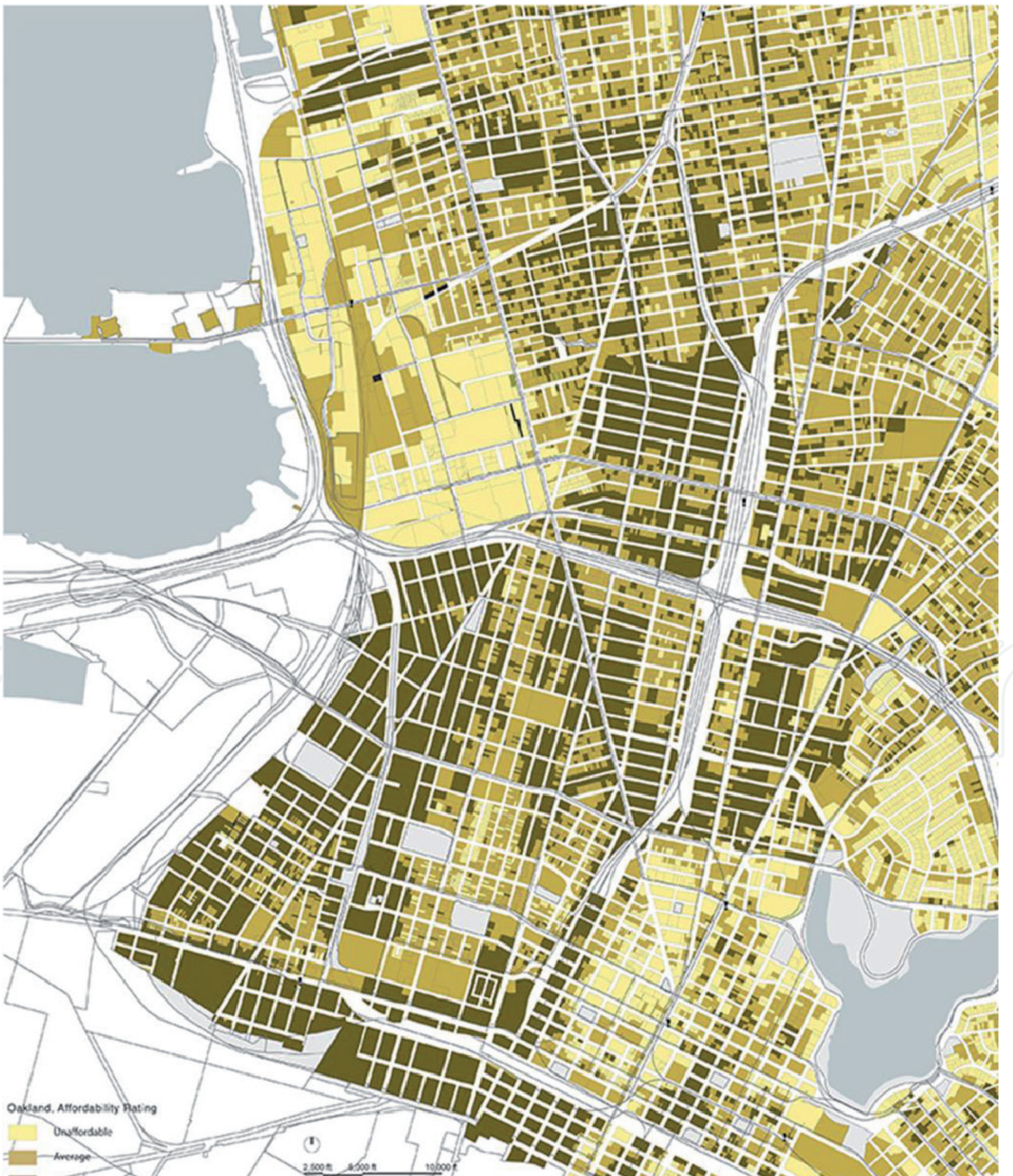

Figure 14.
Amazon Mechanical Turk neighborhood rating: neighborhood affordability evaluation (figure was created by the author) [25].

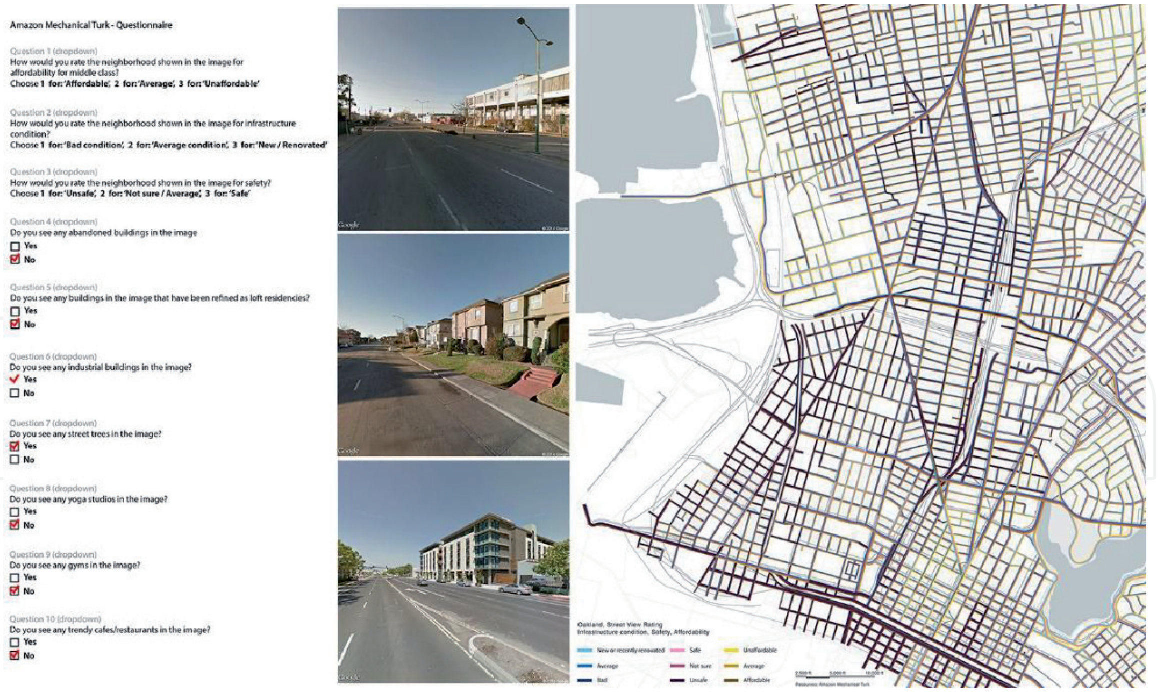

Figure 15.
Amazon Mechanical Turk submitted questionnaire (left) Amazon Mechanical Turk street rating (right) (figure was created by the author) [25].

a multiple choice (tick the box). We avoided completely answers that would require the user to write lengthy texts (**Figure 15**). The received answers were in ".json" format, so they were transformed into ".csv" format as in the previous method.

All data layers were combined and provided the context for a more fine-grained understanding of neighborhood characteristics, conflicts, and relationships that reveal the heterogeneous characteristics of the city [15]. Mapping here is not only addressed as a visualization tool but also as a platform based on which we can make faster and factual assessments [16].

6. Case study 2: urban placemaking through user input

6.1 Introduction

Moving away from the expert urbanist model, which determines the form and functionality of the built environment based on central rules, we argue that engagement with democratic participation can lead to more sustainable and resilient built environments. "Openreblock" platform is an open-ended approach to social justice that offers users active participation and opportunities to reform their immediate environment (**Figure 16**). By encouraging participatory planning via community mapping by its own citizens, it contributes in improving slum communities and their integration in the broader urban fabric. Some of the immediate benefits are land regularization and security of land ownership, allowance for public services, and connectivity.

As urban planning should be understood as a communicative, pragmatic, social practice, this tool facilitates intercultural dialog and implementation. "Openreblock" enables users to reorganize slum communities that lack significant public infrastructure, such as access to a public street. The idea of the tool is that citizens have the right to affect the design of their local neighborhood and have access to an open-source methodology for doing so. It is a web-based service for an open-source platform that proposes the least disruptive reformation of the existing street network

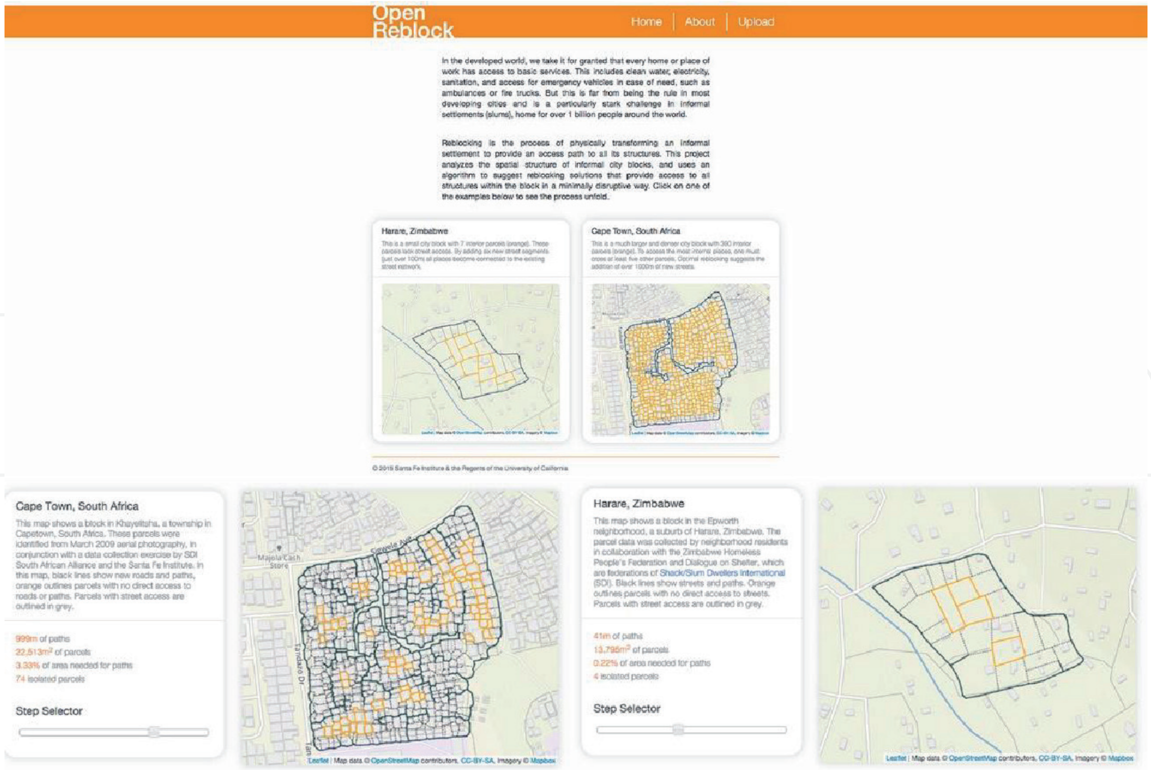

Figure 16.
"Openreblock": website main page, interface, graphics (graphic design by Stamen design).

in order to interconnect slum building blocks that lack access to a public street. This sets the basis for land formalization and property stability, so that *urban slum communities become more resilient to future exploitation and natural disasters.*

Funded through OpenIDEO, it is the product of major research collaboration by the Santa Fe Institute, Sam Houston State University, UC Berkeley, and Shack/Slum Dwellers International, a global network of community-based organizations representing the urban poor. Shack/Slum Dwellers International is a network of community-based groups from 33 countries representing and communicating the needs of the urban poor, engaging international agencies, and operating on the global stage in order to support and advance local struggles for the last 20 years.

"Openreblock" combines the knowledge of slum communities' inhabitants with data analytics worldwide to enable each citizen to become an agent of information with the objective to enrich local knowledge and empower their community to pursue faster and more sustainable development outcomes from the local governments.

6.2 Topology of street network

In order to be able to formalize a strategy on how to evaluate and classify urban fabric typologies, we need to identify some key characteristics that define the character of the urban space. These characteristics should correspond to physical characteristics and relationships between the elements of space, in order to become a quantifiable set of parameters. In our case, the morphology of space that we need to analyze is that of a slum urban block. Although slum communities are diverse in physical appearance, context parcel population, and opportunities, they share common characteristics of organic typology and aggregation of parcels that are a result of unplanned, spontaneous expansion. In most cases, this type of urban development across time results in isolated parcels that do not have access to the street network at all and therefore to any services.

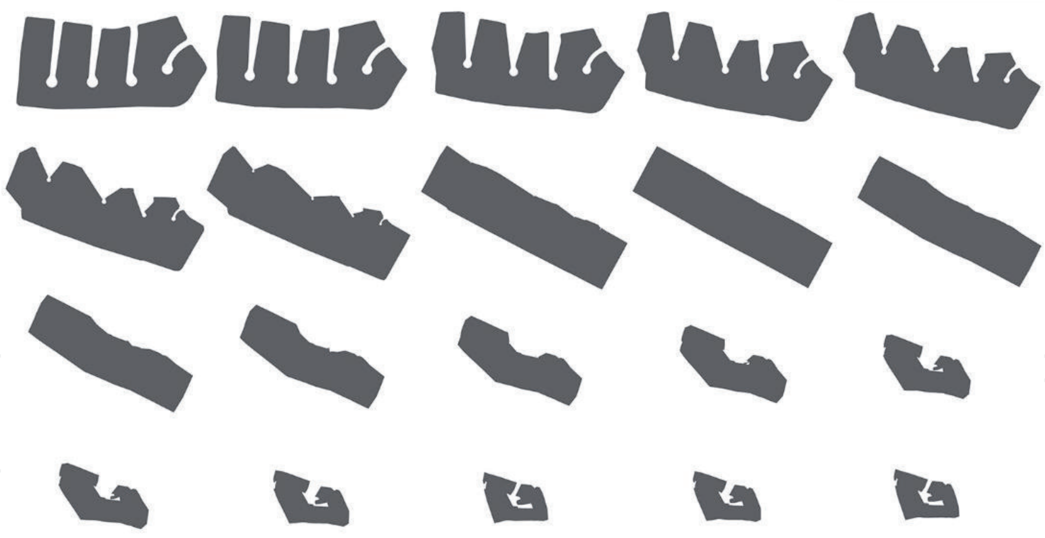

Figure 17.
Topology of a building block-morphing process between three building blocks that share the same topology (figure was created by the author).

The lack of infrastructure appears to be common to most poor or informal neighborhoods, and some of the challenges that these communities are facing derive partially form this fact. Streets are not only used for transportation, they carry all the necessary infrastructures such as drainage, electrical and communication services that interconnect the neighborhoods.

Based on the above, the key quantifiable set of parameters is the topology of the parcels, which reveals parcels with "blind" sides to a public street. In comparison with normal city block that is accessible from all sides, an isolated block would share a common side with one or more of its neighboring blocks. Thus, we can classify the urban fabric quality of any community block from maps that include spatial parcels and access networks in a way that can be automated. We demonstrate an example below of a morphing procedure between three different typologies of urban blocks that have the same topology (same number of parcels and no isolated parcels, common number of nodes), where we can mathematically transform the parcels from one block typology to the other. The third block typology is the output of the "reblocking" procedure of a slum block in Epworth, Zimbabwe, while the other two are from New York and Cape Town. This small example reflects the concept of urban topology evaluation, as the morphing process would have failed if the Epworth block had isolated parcels (**Figure 17**).

Thus, by evaluating the topology of the street network, we can assess more effectively the quality of the neighborhood in terms of public services, connectivity, and social and economic justice in general.

6.3 "Openreblock" platform

"Openreblock" visualizes access to essential services like water, energy, and sanitation at a neighborhood parcel level. This web-based platform requires user input, in order to operate and uses an algorithm to evaluate the topology of the blocks and the continuity of the street network, identify the parcels that do not have access to a public street, and then propose the least disruptive reorganization of a cluster of slum blocks, so that each parcel gets access to a street. It provides the missing connectivity that reduces travel distances and essentially transforms the parcels configuration to commonly known patterns of city building blocks that have access to streets on all sides. The resulting map reflects the changes in the physical layout of the blocks. The solution corresponding to the absolute minimum number of new streets could be impractical for the citizens themselves for the reason that it does not offer enough flexibility; however, it offers a good basis that is easily perceived by the users, in which they can develop and customize further. The process has been enriched by additional functionality that allows the users to exclude streets from the calculation and customize their priorities prior to the calculation based on what reflects their needs best. This is the kind of local knowledge that emerges from processes that allow active user engagement, and its value is immense for the reformation of the community.

The input required is a map of the properties in the community in a shape file format (.shp). The design system is articulated by specific front-end and back-end processes (**Figure 18**). The front-end processes are related to the display of the website based on user demand, which constitute the User Interface, and the back-end processes are related to the background processes needed for the calculation, such as reclustering calculation, queuing of tasks being performed, registering a user in a database, and creating a user profile. As the calculations could potentially demand a

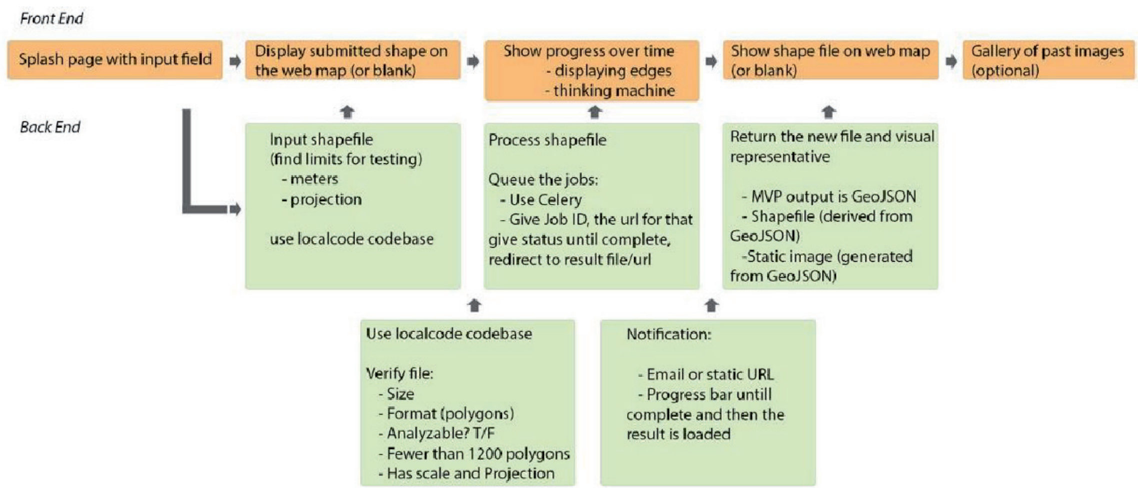

Figure 18.
"Openreblock" design system of processes (figure was created by the author).

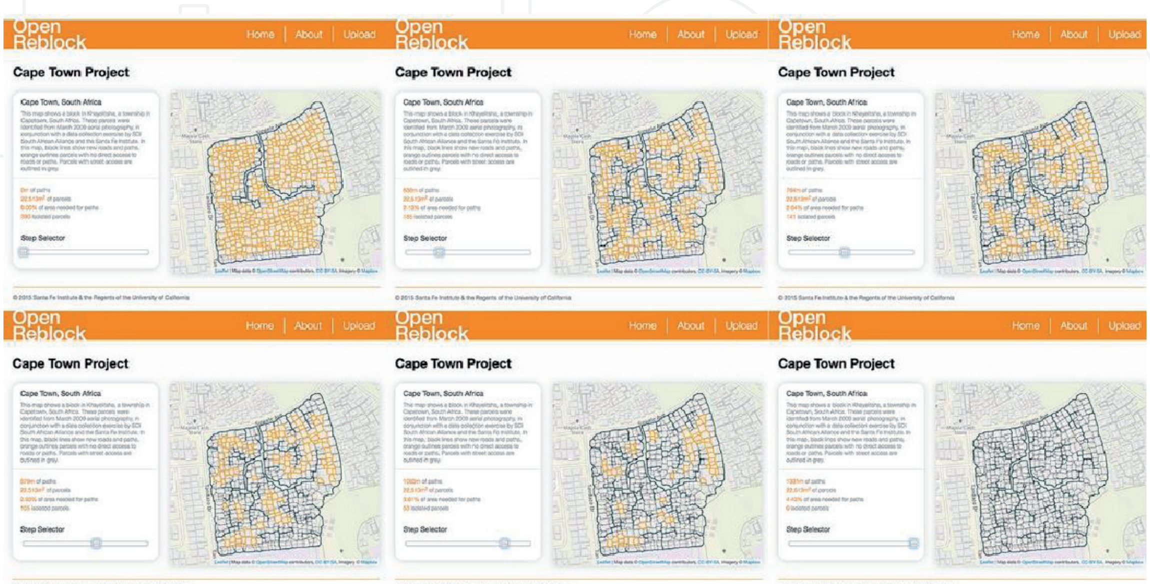

Figure 19.
Cape Town example. Process of "reblocking." New road network is gradually formed (graphic design by Stamen design).

large amount of time to complete, asynchronous task queue/job queue “Celery” has been utilized to queue the tasks in real-time operation. “Openreblock” front-end processes use “Leaflet” and “Mapbox” libraries for the map display, whereas the back-end processes are built in “Jango” library.

In order to make the process of the calculation interactive, the steps are being displayed during the calculation, so the user can spot the new paths that are being generated gradually during the calculation. The user can also access and download any of the intermediate steps of the process. The algorithm estimates the location of existing paths and associated construction costs for new streets, making discussion, and comparison of alternative plans easy. It produces a new map that allows each home or workplace to have an address and to obtain urban services (**Figure 19**). Residents can adjust the tool to their needs by prioritizing processes and use the outcome as an alternative proposal for future replanning, in order to oppress the local government to consider their proposal. Users can optimize the process based on their priorities, such as cost minimization, exclusion of certain paths from the calculation, because they clash with landmarks and width of the new road network for circulation convenience. This allowance for customization is key for local resilience to climate change and socioeconomic development.

7. Conclusions

Due to the staggering rise of technology, our ability to generate data far exceeds our capacity to comprehend the complexity that is entailed in the process of allocating the right kinds of data, analyzing it and finding meaningful connections between different data sets. As this has become one of the biggest challenges that planners are facing, it is important to employ innovative strategies and attempt to go beyond the conventions in data diagnostics. The core of this paper is devoted to an examination of direct or indirect user participation in understanding and pursuing social cohesion in the urban context.

In recent theoretical and policy debates concerning social correlation with the built environment, human participation has re-emerged as an important asset that could provide insight regarding the dynamics of urban space. In this context of renewal of interest in the local, social interactions, the deployment of notions such as, subjectivity, human scale, and temporality offer a critical review of constrained and narrow-sided methods of visualizing the dynamics of urban space solely from a top-down perspective, that of planners and stakeholders. Beyond its sociopolitical implications, participatory approach in urban planning aims to establish a framework toward a more resilient and sustainable environment that benefits both researchers and citizens. From the researcher’s perspective, the ability to visualize and analyze peoples desires and opinions that reflect their background allows for a culturally enhanced database that captures their common aspects and differences as it was demonstrated on the first case study.

The first case study aims to provide a calibrated understanding of the multiple grains of constructed space through top-down and bottom-up methodologies, as well as to offer a tool of visualizing dynamical characteristics of the urban environment. The research balances the traditional census data analysis with more dynamic layers of collective platforms and crowdsourcing. Whichever methodology is considered more or less descriptive of the reality, it is worth examining all the conduits and corridors available to us, by which changes in the urban context are being delivered.

The results of the three surveys were overlapped and weighted in order to produce a series of maps at different scales that visualize gentrification in the Bay Area. Each method described presents certain advantages. The census data analysis provides an overview of the context over a significant time span (2000–2012) and helps us understand major socioeconomic shifts. The open data analysis depicts the ephemeral layer of relationships that take place in the urban environment, which is impossible to be described by authoritative data; however, it is more relevant to the actual conditions, revealing user demands through open-source platforms. The third method enriches the process with cultural inputs are captured as data and user personal feedback about ranking the environment of a neighborhood as it currently stands. Looking at urban issues through maps can give us several hints about spatial and social transformations, in which we can think upon, as visualized information provokes feedback, either logical or emotional. Throughout this entire process, we can assess certain findings:

1. Based on the census data analysis, nearly half of the San Francisco Bay Area census tracts are undergoing some form of neighborhood transformation and displacement.

2. Although varied in their approaches, questions and results, one consistent finding across the three methods is that movers in gentrifying tracts were more likely to be higher income, college educated, and younger in age. This came down to depicting certain categories as indicative that the process of gentrification has already been underway: (a) shift in tenure, (b) influx of households interested in urban living, (c) increase in high-income serving amenities such as music clubs, coffee shops, galleries, etc, (d) rise of educational level.

3. The data accumulated from the open data research depict a significant artists' movement regarding art studio rent requests, artwork sale, and creative services in general in the entire Bay Area and especially in San Francisco and Oakland. The San Francisco arts scene has historically overshadowed Oakland; however, in combination with the staggering rise of rent in San Francisco, we can anticipate that the artist movement will intensify in East Bay in a short timeframe.

4. Studying Oakland at a local street view scale, we can assess that the area is undergoing disperse development that presents high contradictions related to infrastructure condition, affordability, and safety. The results from the crowdsourcing survey vary significantly in building block scale; therefore, any sense of continuity of the same character because of proximity is not necessarily a criterion to rely upon (**Figures 11–13**).

5. Moreover, certain redeveloped areas have uniform functional identity, such as Emeryville, as they present excessive duplication of the most profitable uses (malls, restaurants), while San Francisco and Oakland downtowns present excessive duplication of financial functions (bank district).

6. We notice significant contradictions on the results of the crowed sourced research regarding infrastructure condition, safety, and affordability perception of the participants. Some of the findings depict areas of new development (last 3–4 years) that are yet islanded off because the surrounding area is significantly undermined. However, this contradiction reveals certain dynamics regarding the future, further redevelopment of the area, as well as the areas that accumulate similar features. If we combine the above with the data related to artists' movement and the real estate requests associated with it, we can anticipate that the areas that are currently popular to the artist community will upgrade and the areas that are still undergoing reanesthetization (industrial, abandoned buildings) will follow (**Figure 10**).

This new establishment of relationships is replacing almost entirely the previous condition of gradual displacement and gentrification. It evolves rapidly, and although it looks more orderly, visually, as many areas are undergoing significant upgrading, this esthetic ordering might not have a social correlation. Social structure and social stability are inversely proportional to visual order. This condition is known to be establishing in Oakland, which was significantly undermined in the past few years; however, the challenge is not only to identify the problem but also to find the ways to analyze by mapping its characteristics and communicate it visually to its extents. Understanding the shifts of urban space and finding the patterns that drive them is a big challenge. We support that close engagement with users leads us to explore numerous research methods, which have a way of contributing to meaningful connections inside data networks. We find inspiration in the combination of the traditional ways of space categorization by investigating the relationship of home value, income, transportation, etc., with a bottom-up, participative approach in which individuals provide more ephemeral social elements of neighborhoods.

The second case study is a first step in designing a platform that showcases a social and vital problem of undeveloped slum communities. The primary aspect in designing this tool is to understand the problem through the citizens' perspective, resonate it to a wider audience and formulate methods to represent it effectively.

At the moment, "Openreblock" platform computes and visualizes access to essential utilities such as water, energy, and sanitation at a building block level, along with showcasing how the lack of these may relate to risks or disasters faced by entire communities. The potential contribution of this platform could extend beyond a computational and visualization tool, into a powerful decision-making tool used by both policy makers and slum communities alike, with the objective to improve the lives of the communities through design and data, build partnerships with organizations that could bring innovative solutions and impact stakeholders' strategies to become more tailored toward what is important for the communities.

From the citizens perspective, the ability to collect their own data, own the process of development, and reshape the urban fabric prompts the residents to participate in its evolvement and grow conscience and care for their neighborhood.

As the above case studies open the possibility to operate at a fine spatial scale, examining the city, and neighborhoods, block by block and building by building, they provide the context for a more fine-grained understanding of community characteristics, conflicts, and relationships that reveal the heterogeneous characteristics of the urban space. We argue that the key in improving policy-making is engaging community members to collaborate and take advantage of the available information, in order to become more active members in the society and become able to respond with their own creativity and capacity. From the researchers and planners perspective, the key would be to find ways to anticipate the infrastructural requirements of user involvement, come up with new tools and ideas that maximize the potential for cooperation, coordination, and creativity, while diminishing friction. The future goal would be to design for a convergence of trajectories of citizens, stakeholders, researchers, environment, and local authorities. This could be a first step toward the equalization of power and influence between citizens and stakeholders, which could lead in the collaborative construction of urban space and the understanding of the unique challenges that the city faces.

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Conflict of interest

The authors declare no conflict of interest.

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