Crisis Response in Post-Expropriation Berlin - Investigating its Political Nature and Simulating Collective Action

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Abstract

This paper delves into Berlin's housing crisis, analyzing it through a multidisciplinary lens by integrating Eva von Redecker's critique of capitalist ownership constructs and empirical findings with data synthesis and simulation techniques. Understanding the housing crisis as a reflection of broader socio-political issues and focusing on ownership, displacement, and collective action, we explore how privatization and speculative investment have transformed housing into a commodity, exacerbating issues like gentrification, homelessness, and displacement. To combat these issues and explore expropriation as a viable solution, we synthesized real-world data from multiple sources to create a comprehensive dataset reflecting Berlin's housing landscape, which then informed simulations of potential collective responses to crises in a post-expropriation setting. In doing so, we are proposing a framework where communal decision-making and shared ownership counteract displacement and speculation. The convergence of theoretical insights and empirical data through simulation offers a novel perspective on urban housing crises. By examining various crisis scenarios and their intersections with ownership, this research underscores the potential of collective action and reconceptualized ownership to address urban crises.

I. The Problem

I. Berlin's Housing Crisis

The fabric of urban living is intricately woven with the dynamics of space, power, and resource distribution, fundamentally shaping the experiences and responses of its inhabitants. Due to it's history, Berlin has always been an important case when it comes to urban transformation, planning and its (social) housing policies. Once even defined as 'poor, but sexy' by its ruling mayor back in 2003 [9], Berlin has witnessed some of the most rapidly rising property prices in Europe. This development can be observed not only in the city center, but is a phenomenon spanning the whole city, including the periphery. This process goes hand in hand with massive displacement of low-income tenants [10], and is why urban housing researchers like Robert Kitzmann and Andrej Holm frame the current situation no more under the umbrella of gentrification but rather speak of an outright housing crisis, characterized by high rents and shortage of affordable housing, frequent evictions, ongoing lack of maintenance and social segregation processes associated with ownership [10].

With the aim of understanding this crisis, Holm and others trace the origins of the current Berlin housing crisis to the massive privatization of public housing, which was was heavily pursued after the unification until the mid-2000s. During this time, decisions of national and local policymakers led to the privatization of roughly half of the publicly owned housing stock, reducing 580,000 units in 1990 to less than 300,000 by 2005 [1]. According to

Kitzmann, this was characterized by "en-bloc sales of huge portfolios and entire companies to yield-oriented Anglo-American investors", and these early developments are still visible in today's composition of the housing stock: While the proportion of stock-market-linked housing in Germany is two percent, in Berlin it surpasses 20 percent. In a city in which 85 percent of residents are long-term renters, the majority of apartments (57 %) are now investment properties owned by "a few thousand multimillionaires", and only a quarter are rental apartments owned by the city, non-profit organisations, and housing co-operatives. Only 15 percent of the apartments are owner-occupied [23].

As an outcome of this, housing units are transformed into objects of financial speculation, when their intended purpose is to provide for and fulfill a fundamental human need. While the initial wave of property privatization did not impact residents significantly, the city's low rents soon attracted a strong influx of residents, and the situation changed post-2008 when investors targeted the undervalued Berlin market. Major acquisitions, like Deutsche Wohnen's purchase of 60,000 apartments, marked a shift towards aggressive rent increases and tenant displacement strategies. This trend culminated in a citywide concern over housing commodification, evidenced by a referendum targeting large for-profit housing owners, reflecting a broader anxiety about Berlin's homes being traded on international markets [11].

Berlin, in this regard, is a good example of a city that has been dealing with different crisis situations and finding ways to resist against and tackle these crisis throughout its history. Although our initial problem focus was the housing crisis in Berlin, looking at its outcomes, the intersecting topics and the groups mainly affected by it, has expanded this work's focus to crisis situations generally, their perception and potential collective responses to them in context of housing and displacement. We contextualize the housing crisis as a symptom of broader socio-political undercurrents which challenge the very essence of community, displacement and belonging, and explore further the intersections of housing, space, ownership and crisis. At this nexus, collective action emerges as a counter-narrative to displacement and disenfranchisement. In our search for solutions, we thus examine and highlight various forms of collective action and develop our own concept, attempting to chart the contours of a city in flux that constantly re-negotiates the composition of urban coexistence, and questions what constitutes a crisis.

II. The Political Nature of "Crisis"

A crisis can be broadly defined as a critical point or state of affairs necessitating urgent and decisive action Merriam-Webster. It typically involves situations that are perilous or unstable, that demand immediate attention and resolution. Among many other definitions, it can be defined as "an unstable or crucial time or state of affairs in which a decisive change is impending. Especially: one with the distinct possibility of a highly undesirable outcome" (ibid).

However, the perception of what constitutes a crisis is very subjective and can be heavily influenced by political agendas, media portrayals and societal and cultural values, therefore its perception and response vary across different contexts and regions. Immediate threats, such as natural disasters or war, often provoke rapid responses due to their direct and visible impacts, whereas less obvious issues like economic downturns or housing crises may elicit slower, delayed, or more deliberated responses. Perception does not only shape the urgency of the response but also its scale and type. Whether a crisis is perceived as immediate or unfolding over time significantly affects how decisions are made and who gets involved in the decision-making process. For instance, while immediacy can streamline decision-making processes [3], when a crisis is perceived as protracted or less immediate, the decision making process can become more participatory and inclusive, allowing for a broader

range of inputs and deliberation [16], such as in the case of a housing crisis and civil initiatives.

With market-driven gentrification processes transforming housing into a contested space and exacerbating social inequalities, the public framing of Berlin's housing situation as a crisis has catalyzed and mobilized public engagement and resistance. In contrast, other issues which lack this framing in turn experience a lack of such attention, engagement and urgency. The interplay between the perception of crises and the political, economic, and social dynamics underlying housing in Berlin elucidates broader global challenges, such as homelessness, refugee displacement, and climate-induced natural disasters. These issues, while varying in immediacy and visibility, converge on the fundamental human need for stable, secure habitation and the political agency in framing and addressing crises. The comparative analysis reveals a spectrum of crisis recognition and response, illustrating how the urgency and nature of political and societal reactions are contingent upon the framing of an issue as a crisis.

II. Theoretical Background

In developing the theoretical framework of our research we draw upon the critical insights of Eva von Redecker, Robert Kitzmann and Andrej Holm, whose work jointly provides a rich spectrum of perspectives on urban housing crisis, ownership and the socio-political dynamics of space. With her research, Von Redecker critically addresses and traces the origins of the construct of ownership to its capitalist origins, arguing that it fosters alienation and exacerbates socio-environmental issues. She advocates for a reconceptualization of property, suggesting that ownership should be viewed through the lens of social relationships and responsibilities rather than legal entitlements, and emphasizes that true value arises from cooperative and sustainable interactions within communities. Her critique of ownership within capitalist frameworks offers a foundational perspective through which we examine the dynamics of property, the right to housing and expropriation [17].

In this regard, Andrej Holm, who has produced long-going analyses of Berlin's urban development and housing policies, illustrates how market forces and policy decisions displaces long-standing communities and deepens social inequalities and argues for more inclusive and socially responsible urban planning and housing policies that prioritize the needs and rights of all residents, especially the marginalized and economically disadvantaged [8]. Integrating Holm's findings allows for this research to be based on concrete realities of Berlin's urban landscape, that provides not just a critical but also an empirical dimension that complements Eva von Redecker's theoretical perspectives. This synthesis of ideas forms the theoretical bedrock upon which our project is conceptualized.

III. Solutions

I. Conceptual Development

In the process of defining the problem we wanted to tackle and brainstorming our solution, we were led by the guiding question: How can we alleviate or improve aspects of the Berlin housing crisis on the basis of real-world data? This led us to various avenues of interest and solution ideas which we explored over the course of the project. In order to narrow down the solution space opened up thereby, we follow Andrej Holm's focus on empirical data and marginalized groups which are more prone to suffer from the effects of the housing crisis (e.g., migrants, students and low-income earners), as well as Eva von Redecker's perspectives on ownership, which functions as a unifying element, tying it to crises and global displacement.

Expropriation

In Berlin's heated political climate surrounding landlord-tenant relationships, arising out of the above described environment of the housing crisis, the notion of expropriation has

emerged not only as a vague concept, but as realizable opportunity on the political horizon. The civil engagement initiative "Expropriate Deutsche Wohnen & Co." ('Deutsche Wohnen und Co. Enteignen') which in its name targets the largest real-estate company in Berlin), aims to collectivize Berlin housing stock owned by large real-estate corporates. This ongoing initiative stems from a referendum held and passed in Berlin in 2021, in which voters were asked if they approved of the expropriation of the property of private real-estate companies with 3,000 or more units in the city through public purchases by the Berlin state government. This would affect 12 large real-estate companies and 243,000 rental apartments out of 1.5 million total apartments in Berlin [**dwe**]. The demand is based on a basic legal right, namely Article 15 of the German constitution, which specifically allows for expropriation for public benefit, reaffirmed by numerous legal scholars. Although the referendum was non-binding, it won a large majority in 10 out of 12 districts in Berlin - a testament to the existence of lawful, democratic, and realizable ways to tackle the housing crisis in Berlin [11]. The people behind Expropriate Deutsche Wohnen & Co. continue to work hard at realizing their goal, further concretizing their idea and its implementation [7]. After getting in touch with the initiative, we received helpful data on the Berlin housing landscape (as detailed below), on which much of this project is based.

Simulating Urban Housing Policies

Initially, we planned to conduct policy simulations that change the ownership structure of the housing stock, and potentially simulate landlord and tenant actions in such a restructured policy environment. This could have been done through the introduction of an innovative new taxation scheme (e.g., taxing every second, third, ... flat, incentives for co-ownership, etc), or the adaptation and simulation of a historical policy predecessor, such as "Red Vienna", Austria's capital in the time between 1918 and 1934. [1]

Another policy simulation idea was to optimize the distribution of rent prices across districts so that 1) as many people as possible would get access to affordable housing, and 2) mixed-income neighborhoods emerge. The rationale behind this was to diversify the socio-economic composition of the city, decrease the spatial concentration of classed communities and enable synergy effects that are assumed to improve opportunities to upward mobility for lower-class households and the socio-economically disadvantaged [13]. However, as several scholars point out ([6], [22]), more is needed for mixed-income communities to be integrated not only spatially but also socially, highlighting the need for spaces of cross-class encounters that happen on an equal footing, which adds many layers of complexity to such urban planning endeavours.

Eliminating Vacancies

Despite the serious shortage of affordable living space, a significant amount of properties are deliberately kept vacant by landlords for reasons of speculation and profit-increasing renovation purposes. Existing legal instruments are already aimed at restricting and preventing this misappropriation of housing, which also includes vacancies longer than three months. [2] While these measures may appear effective in theory, there is often a lack of actual enforcement due to a variety of reasons [15]. As of now, there is a lack of reliable and representative data on the extent of this issue, which is mostly gathered through citizen-initiative (e.g., [12]), so we decided to not further pursue this route.

[1] In response to severe housing shortages, a rigorous program of construction projects was set in place across Vienna during this time, combined with a progressive housing tax that led to .5 % of properties generating almost 45 percent of the housing tax revenue [18]. This tax revenue could in turn be used for establishing affordable housing solutions.

[2] The Prohibition of Misappropriation Act ("Zweckentfremdungsverbot-Gesetz", ZwVbG) is a Berlin state law that prohibits the misappropriation of residential space, and essentially regulates that apartments within the state of Berlin may only be used for residential purposes unless a corresponding exemption permit has been obtained.

Co-Living
Finally, we investigated the idea of co-living as a possible driver to alleviate the housing crisis. First of all, living with others frees up much-needed housing space. However, it goes beyond that, since it may also foster a strong sense of community and bridge divides across countries of origin, race and class, and even transform our understanding of citizenship itself [2]. A case study from Antwerp has shown promising results in successfully integrating refugees through co-living arrangements [14], a task that is complicated by the housing crisis, as many refugees suffer from overcrowded housing facilities and shortage of affordable and accessible alternatives.

Furthermore, the decision to live together collectively in a longer-term structure can also be a viable option to stop privatization on a smaller scale. The "apartment-house syndicate" ("Mietshäuser Syndikat"), a German cooperative and non-commercial joint venture which helps communities acquire long-term affordable living space via a legal, collective property arrangement, effectively ensures that a bought property will not be reprivatized [21].

Converging on a solution
The conceptual framework of post-expropriation crisis response (explained in the following) in which we base our simulations and calculations combines many of the aforementioned partial solutions to tackle the housing crisis: elements of a (simplified) policy approach, alternative structures of ownership via the embedding in an expropriation context, and finally, eliminating vacancies through co-living arrangements. Observing how much global and local crises (of housing, displacement, inequalities) overlap at the common nexus of ownership, using the framework of how the inhabitants of an expropriated Berlin may collectively respond to crisis scenarios appeared as a suitable way to tie our research together. Importantly, this narrative also allowed us to utilize the data we had gathered in innovative ways.

II. Application Framework

Crisis Response in Post-Expropriation Berlin
For our calculations, we imagine a semi-specified crisis scenario (see below) and simulate potential collective action which may be taken by Berlin inhabitants after expropriation has taken place. More specifically, we imagine that a crisis affects Berlin residents such that private rooms need to be made available in order to tackle the crisis. In such a case, assuming collective ownership over the housing units (a given in this envisioned expropriated reality), we presume that the collective may decide on a simple heuristic in order to free up space. In our concrete narrative, this heuristic is worded as follows: Every flat that has X spare rooms is required to make Y of these rooms available in a crisis situation for crisis management. Simulating the outcome of such a heuristic, based on calculations on the real-world data we have gathered and synthesized, allows for the analysis of impact for different values of X and Y respectively, as seen in the results section.

While the specified heuristic is a strongly simplified way of conceptualizing crisis response, it allowed us to effectively accomplish several design objectives. First, it makes effective use of the high-resolution data we have gathered and synthesized on the Berlin housing landscape (see below), enabling the simulation and impact analysis of such a heuristic and illustrating its real-world effects. Second, it allowed us to tie a multitude of crises to questions concerning ownership, as they are all connected through the shared effect of displacement and the need for housing. Furthermore, the chosen narrative illustrates a possible solution space to global and local crises which are connected by the issue of displacement, which is enabled and opened up only through a revolutionized understanding and structuring of ownership in the housing landscape. Third, the simplified heuristic is easy to understand, especially in comparison to more bureaucratic and complex housing policies, promoting low-barrier engagement with the topic. Last but not least, the crafted narrative surrounding

crisis management in post-expropriation Berlin presupposes an unquestioned reality in which expropriation has already taken place. Rather than asking questions concerning the actual process and organization after expropriation, it instead focuses on very specific scenarios, thereby normalizing the idea that expropriation is a feasible option and could already have taken place.

Scenarios

In order to enable consistent calculations of possible collective responses, these imaginable crisis scenarios are all defined by a set of constraints as follows. Each scenario has to yield a clear target number of rooms and area, has to give information on priorities of the crisis response (i.e., area, number of rooms, people affected), has to be geographically bound (e.g., limited to a certain area, district, or the whole city). We can then analyze each response's "impact", i.e., the number of rooms made available for crisis response, the area gained, and the people affected by this action.

As an exemplary crisis scenario, we can imagine a severe fire in the district Steglitz-Zehlendorf. This scenario analyses the feasibility of making up space in a specific area during a city-internal crisis situation. In this case, we can assume a demand of approximately 15,000 rooms [3] that need to be made available, e.g., in order to house evacuees affected by the fire.

Many possible scenarios are imaginable that can constitute a city-wide crisis. Initially we thought about displacement caused by war outside of Berlin (or Germany), resulting in an influx of affected people entering Berlin in order to seek refuge and asylum. In such as case, depending on the scale of the displacement, the whole city may be affected, and refugees may initially set a low priority on the actual location within the city. Besides war-caused displacement, other forms of displacement are imaginable, such as having to leave one's home due to natural disasters (especially in face of the increasing likelihood of extreme weather events due to climate change). However, one may not even need to conjure up a projection of a potential crisis, as existing issues already serve well as exemplary crisis scenarios. To give an example, homelessness is also a city-wide (and beyond) issue that urgently needs to be addressed, and one that could benefit from inclusion into co-living arrangements. While in this context we focus on the short-term crisis response in all of these scenarios, we acknowledge that they require both immediate action and a long-term solution.

IV. Technical Implementation

I. Data Sources and Synthesis

As a basis for our simulations, we synthesized two data sources into a single large dataset.

The first data source was provided by the civil engagement initiative 'Expropriate Deutsche Wohnen und Co.' (see section I). The data provided by this initiative comprises detailed information on approximately 7,000 flats in Berlin, including characteristics such as the owning company, geolocation data, living space area, number of rooms, and rent per square meter.

The second data source is the German Microcensus, a public statistical survey carried out annually, using a representative sample of one percent of the German population and households. It provides an aggregated overview of housing-related features distributed across Berlin, such as household net income per household size, household size per district and household net income per district.

To fuse these two data sources and syn-

[3] To establish the amount of rooms that need to be made available, we speculatively assume that a significant portion of the district (20%) near the forest is at risk and the population (approximately 300,000 inhabitants) in the district is distributed relatively evenly, so roughly 60,000 inhabitants may be affected. Since not everyone in the affected area would need evacuation (some might be away, and others might reside in areas less threatened), we may adopt a 25% evacuation rate from the at-risk population, yielding approximately 15,000 people. While the actual figure would of course depend on numerous variables, such as the exact nature and spread of the fire, the specific areas affected, and the effectiveness of local emergency response strategies, we can use this figure to approximate the sketched-out crisis scenario.

thesize the combined dataset, we randomly assigned a numerical value for both household size (between 1 and 4, matching the Microcensus data) and household net income to each flat in the first dataset, so that the resulting distributions across districts mirror those provided by the Microcensus. The thus produced dataset therefore constitutes a detailed representation of the Berlin housing landscape based on real-world data.

II. Accuracy Analysis

To assess the accuracy of our synthesized data set we compared the resulting distributions to those detailed in the Microcensus [20]. More specifically, we conducted Chi-squared goodness of fit tests using a Python script and calculated mean absolute errors as deviation indicators. Our synthesized household size distribution for each district deviates from the expected distribution by MAE = 2.64 percentage points on average for each household size category. Chi-squared tests yielded only large p-values ($p > .996$, $\chi^2 = .061$), and the maximum mean absolute error was 4.62 percentage points (Pankow).

The synthesized household income distribution for each district deviates from the expected distribution by MAE = 2.52 percentage points on average for each household income category. Again, Chi-squared tests yielded only large p-values ($p>.98$, $\chi^2=.434$), and the maximum mean absolute error was relatively low with 4.42 percentage points (Marzahn-Hellersdorf). These findings suggest that the synthesized data closely matches the expected distributions, with some deviations that are, on average, relatively small in magnitude. We accept this level of error in the context of our analysis and the precision required for our application.

III. Impact Analysis Calculations

Having successfully synthesized the unified data set comprising the information on flats, integrated with the city-wide distributions of various variables, we subsequently analyzed the impact of each variable assignment. To do this we again developed a Python script. This script iterates through all possible value assignments of X and Y, and for each assignment goes over the stock of flats and checks whether a flat would meet the criteria and thus be applicable to the heuristic, i.e., whether it has minimum X rooms more than it has persons living in it (= spare rooms). If so, 1) Y rooms are added to the amount of rooms made available, 2) the area gained in total is increased by the total flat area divided by the amount of rooms (presuming all rooms are roughly equal in size), and 3) the number of residents affected is increased by the amount of people living in the affected flat (as all of the residents would be affected by a newcomer and / or a crisis-specific usage of their living space). When calculating the impact in a certain district only, the flats to iterate over is limited to those located in the specific district. The resulting figures can be seen in tables 1 and 2. All code can be found on Github in a private repository [19], as the data providers asked us not to publish it without their permission.

IV. Data Visualization

In order to illustrate the effects of heuristic crisis response and offer a thought-provoking exploration of the significance of collective urban decision making, we implemented an interactive data visualization interface using the Plotly Python Graphing Library and HTML, which enables a hands-on exploration of the solution space derived from our conceptual framework (figure 1). It displays the solution space as an interactively manipulable 3D graph with three objective axes (rooms made available, area gained, people affected) and highlights the multi-objective nature of decision making: There is no single optimal solution, and the prioritization of one objective over another depends on the specific crisis situation (see paragraph V). The data visualization interface allows users to gain an overview of the effects of each policy in a crisis scenario, aiding a thorough understanding of the potential impact of these policies. When hovering

over data points, tooltips offer more insights on the nature and effects of the selected policy, further illustrating and concretizing the conceptual framework.

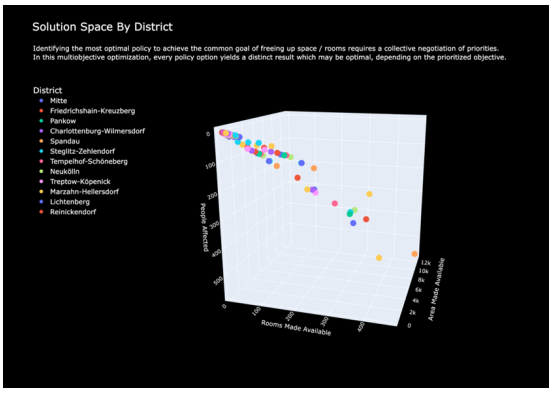

Figure 1: *The interactive data visualization interface*

V. Results

For each scenario - which features a certain scenario description, decision making priorities that arise out of it, as well as a target number of rooms - we can ask the question: What values of X and Y do we need to employ in the heuristic framework (detailed above) in order to make the required amount of rooms available?

Table 1 shows the computed results for various assignments of X and Y for the district Steglitz-Zehlendorf. We can see that with X=1 and X=2, the target amount (15,000) of rooms becomes available. In other words, if every apartment in Steglitz-Zehlendorf which has at least two spare rooms (X = 2) made one of them (Y = 1) available, there would be more than enough space to house all evacuees. Due to the nature of the sketched-out crisis scenario, solidarity towards the affected persons can be estimated to be rather high - after all, potential fire evacuees are effectively the affected residents' neighbors. Therefore, decision makers may focus on maxing out the number of rooms made available, and be less concerned with the number of residents affected.

Since we have not specified a clear scenario for a crisis that affects the whole city of Berlin, we can not draw similar conclusions regarding decision making priorities for the results in table 2. Nonetheless, one can gather from this table how many rooms could approximately be made available (taken from the set of all expropriated flats) if all households with X number of spare rooms would make one available. For example, looking at the case of homelessness, in 2022 Berlin city estimated the amount of homeless people in Berlin to be roughly 7,000, which the number surely increased by now [4]. Theoretically, if the collective wanted to make space for all of these inhabitants, it would (more than) suffice to ask every household with two or more spare rooms (X=2) to make one available, as this would already yield approximately 35,000 rooms.

Table 1: *Impact analyses for Steglitz-Zehlendorf*

X	Y	Rooms made available	Area gained (sqm)	Residents affected
1	1	78,297	2,131,319	93,407
2	1	26,099	699,451	29,945
3	1	8,516	221,429	9,615
4	1	2,466	64,835	2,747

Table 2: *Impact analyses for the whole city of Berlin*

X	Y	Rooms made available	Area gained (sqm)	Residents affected
1	1	115,425	140,624	3,023,674
2	1	35,425	39,515	873,102
3	1	6,482	6,898	158,683
4	1	971	1,005	25,165
5	1	104	104	3,120

Optimality Considerations

Since we are aiming to identify the most optimal solution and each possible solution (each assignment of X) has different effects towards the three objectives, this constitutes a multi-objective optimization. We can thus apply the concept of pareto optimality. For each crisis scenario, a solution (e.g. X = 2) is pareto-optimal if none of the objective functions (i.e., rooms made available, area gained, residents affected)

can be improved in value without degrading one or more of the other objective values. However, without additional subjective preference information, there may exist a (possibly infinite) number of Pareto optimal solutions, all of which are considered equally good (also called the "pareto front", as seen in figure 2). This is why when prioritizing decision making, the objective of solving a multi-objective optimization problem becomes aiding an expert in identifying the (Pareto) optimal solution tailored to their preferences [5]. Here, the presumption is that one actionable solution is selected for practical application. In this context, an expert in the problem domain (e.g., a professional in crisis management) becomes crucial, as their insights inform the prioritization process necessary for each specific scenario.

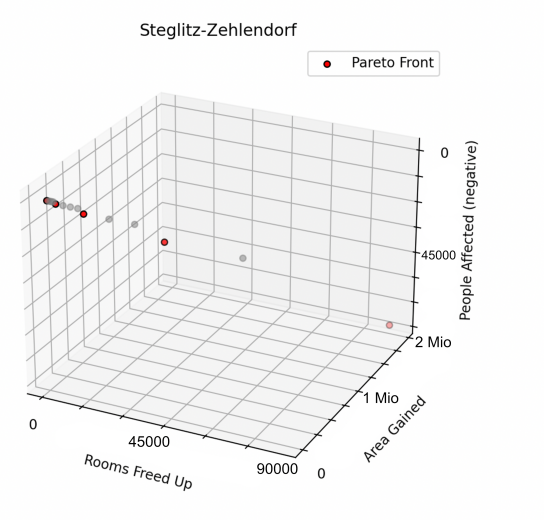

Figure 2: *The solution space and pareto front for Steglitz-Zehlendorf*

VI. Discussion

This paper details our process of researching, reflecting on and developing a solution space related to the Berlin housing crisis and related and entangled themes of global crises, specifically those concerned with ownership and displacement.

In this context, Eva von Redecker's critique of ownership within capitalist frameworks has provided us with a profound lens through which to understand how the unifying element of ownership exacerbates crises like housing shortages, homelessness, displacement due to conflict and climate change impacts. She argues that the capitalist view of ownership, focused on legal rights and economic benefits, overlooks the importance of community welfare and sustainable practices. In Berlin's housing market, this perspective on ownership has led to privatization and investment practices that prioritize profit over people, converting housing from a basic need into a market commodity. This shift highlights a broader societal trend of valuing property rights above human needs, a concern central to von Redecker's critique, which is similarly reflected in the situation of the homeless, whose fundamental right to personal space is not granted based on capitalist logics of entitlement.

Reconceptualizing ownership to embrace communal and sustainable values, as von Redecker advocates, could redefine our approach to various crises. Through this lens, ownership is not just a legal bond between an individual and an object or property; it's a complex web of relationships, responsibilities, and rights that extend beyond individual or corporate ownership to encompass communal stewardship and intergenerational guardianship. This broader, more inclusive understanding of ownership could inform and transform policy responses to different sorts of crises, promoting solutions that are equitable, sustainable, and reflective of shared human values and collective well-being.

In this work, we aimed to explore this reconceptualized understanding of ownership through a combination of conceptual and data-based analyses and visualizations. By developing scenarios set in a post-expropriation context, we have highlighted the importance of collective action and decision making. By embedding these notions in a simulation and optimization framework, we have learned that there are many levels of complexity to a crisis even in such simplified cases. In our application of multi-objective optimization to evaluate

the outcomes of different crisis response strategies, we incorporated pareto optimality considerations to balance competing objectives such as maximizing available rooms, minimizing resident displacement, and optimizing space utilization. By engaging with these optimality considerations, our study not only identifies feasible solutions but also highlights the nuanced decision-making processes required in managing urban crises.

I. Limitations

Due to the limited resources and scope of this project, several considerations concerning the conceptual framework need to be kept in mind. First, our approach to crisis response in the form of a simple two-parameter heuristic is of course a strong simplification. It serves to provide a computational basis for simulation and highlights the potential of collectively deciding on a simple rule. However, real-world crisis management will naturally have to employ more complex means of response. Second, we have excluded the question of how such a heuristic would be decided upon by the collective. To provide a thorough background and answer to this question, more research in collective decision making is needed. Third, since only a subset of flats would be eligible in each policy scenario, some residents will be disproportionately affected. This may be alleviated through e.g., reimbursements to support affected people, or adapted contracts which secure the duty to make one's room available in specified crisis scenarios. Fourth, basing crisis response on civil initiative rather than deciding on a top-down policy may arguably be more in line with ideas of collectivization. In summary, despite certain limitations to the developed conceptual framework, it nonetheless offered a valuable means to achieve our objective of exploring and making tangible an expropriated reality, as well as effectively communicating contingencies and interconnections in global crises.

There are a few limitations concerning our synthesized data set. We have already indicated and specified via a mean squared error analysis to what extent the resulting distributions (in terms of household size and income) deviate from the specified constraints. On top of this, the data from which we gather the population's distribution is subject to its own limitations, e.g., by way of sample size. Since the Microcensus sample consists of approximately 1 percent of the German population, there are certain limitations concerning the distribution's validity, reliability, and generalizability.

VII. Where do You go from here?

Considering that the presented solution space has already sparked a substantial amount of constructive debate surrounding our intended themes during a university exhibition, we see potential in the further development of this project. Honing in on the collective decision-making processes, disentangling the related layers of complexity and incorporating them into our model can be a next step to creating an effective simulation and decision-making tool used for future real-life applications. The high resolution data provided by the Expropriate Deutsche Wohnen & Co. initiative, especially in our modified and extended version, still offers a lot more potential for further simulations, optimizations, the implementation of more interactivity, etc. These continued developments could incorporate some more of the complex aspects that were left out in this iteration, such as rent prices, maintenance fees, taxation etc. The positive attitude and interest in the project from Expropriate Deutsche Wohnen und Co. opens up further space for collaboration, with the potential to advance the campaign's goals by concretizing and simulating the lived reality in an expropriation context. The project still has a lot of room to grow and by further developing it, we aim to produce useful research and tools that can cross the realm of academia to real-life, present people with new perspectives and invite them to reflect on and question the notions we have questioned ourselves over the course of the last months.

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