PLANNING SPATIAL OBSOLESCENCE: RACIAL CAPITALISM, THE HOME OWNERS' LOAN CORPORATION, AND THE PRODUCTION OF RACIALIZED DEVALUATION

by

SCOTT NYLAND MARKLEY

(Under the Direction of STEVE HOLLOWAY)

ABSTRACT

Two critical rediscoveries in sub/urban scholarship have emerged alongside one another in recent years. On one side, a resurgent interest in racial capitalism has recast capitalist processes as inseparably connected to racism. On the other side, renewed attention on the Home Owners' Loan Corporation's (HOLC) so-called "redlining" maps sparked an explosion of studies linking this New Deal-era federal surveying program to a series of present-day socio-spatial inequities across the United States. Despite their parallel development and overlapping interests, these lines of scholarship have seldom come into contact. In this dissertation, I bring them together to enrich our collective understanding of each.

Specifically, I advance two main arguments. First, I contend that the "racist theory of value" expressed throughout HOLC's mapping materials has been a key innovation for managing the geographies of devaluation in racial capitalism. Through my qualitative engagement with the HOLC maps and their attendant field notes for Atlanta, Georgia and Milwaukee, Wisconsin, I uncover two related cartographic narratives of

value that suggest a “racist theory of value” in formation. Focusing on the perceived temporal and spatial threats of non-white residents, respectively, these value narratives highlight a key function of racial housing segregation in racial capitalism: to delimit and contain the devaluation immanent to capital accumulation in Black spaces.

Second, I contend that the current HOLC literature’s narrow focus on how the maps’ D-graded areas overlay present-day social injustices undersells the significance of racism in shaping the contemporary sub/urban housing landscape. By decoupling race from the map grades in my statistical analyses, I show that since 1980, a neighborhood’s Black population share has had a far more salient impact on its home values than its HOLC grade. Accordingly, I propose that scholars treat the HOLC mapping materials as reflective rather than prescriptive. Rather than obliquely investigating the persistent geographies of racialized devaluation by way of the HOLC maps, I suggest researchers shift their focus to the racially segregated geographies of value directly.

INDEX WORDS: Racial capitalism, Home Owners’ Loan Corporation, redlining, racist theory of value, critical cartography, narrative inquiry, urban geography, urban studies, housing, Geographic Information Science, Atlanta, Milwaukee

PLANNING SPATIAL OBSOLESCENCE: RACIAL CAPITALISM, THE HOME OWNERS' LOAN CORPORATION, AND THE PRODUCTION OF RACIALIZED DEVALUATION

by

SCOTT NYLAND MARKLEY

BA, Georgia Southern University, 2013

MS, University of Tennessee, 2016

A Dissertation Submitted to the Graduate Faculty of The University of Georgia in Partial Fulfillment of the Requirements for the Degree

DOCTOR OF PHILOSOPHY

ATHENS, GEORGIA

2023

PLANNING SPATIAL OBSOLESCENCE: RACIAL CAPITALISM, THE HOME OWNERS' LOAN CORPORATION, AND THE PRODUCTION OF RACIALIZED DEVALUATION

by

SCOTT NYLAND MARKLEY

Major Professor:	Steve Holloway
Committee:	Nik Heynen
	Jerry Shannon
	Anne Bonds

Electronic Version Approved:

Ron Walcott
Vice Provost for Graduate Education and Dean of the Graduate School
The University of Georgia
May 2023

DEDICATION

This dissertation is dedicated to Nancy Lee Nyland Markley (1934 – 2022).

ACKNOWLEDGEMENTS

This dissertation could not have been written without the support of friends, family, mentors, and colleagues. I extend my deep gratitude to my advisor, Steve Holloway, for his guidance and attentiveness. His commitment, engagement, wisdom, and care elevated the quality of this work tremendously. I also express my sincere appreciation to my committee members Nik Heynen, Jerry Shannon, and Anne Bonds. Their feedback throughout this process greatly improved this project.

I am also indebted to the many enriching discussions I had in class and out with my friends and colleagues in the Geography Department. I am most appreciative of the countless conversations and debates I had about theory, praxis, and method—usually over a drink—with my dear friends Coleman Allums and Taylor Hafley. Additionally, I am honored to have worked alongside such a talented, creative, and caring group of scholars from whom I learned so much, including Nikki Luke, Caroline Keegan, Sara Black, Rachelle Berry, Aidan Hysjulien, Matthew Harris, Jonathan McCombs, Dani Aiello, Christian Petterson, Jess Martinez, Castle Williamsberg, Ian Rossiter, Sam Weber, Aspen Kemmerlin, Chelsea Wesnofske, Nick Morgan, Neil Debbage, Shaina Poore, Amy Ross, Joshua Barkan, Xiaobai Yao, Dave Porinchu, Marshall Shepherd, Amy Trauger, and Hilda Kurtz. It was through these many interactions and conversations—especially those sparked in Nik's Racial Capitalism seminar in Fall 2017 and Jerry's Suburbs seminar in Spring 2018—that provided me the foundation of this project.

Outside the Department of Geography, I benefitted greatly from many other collaborations. I am most thankful for the experiences of working with Hee Cheol Chung, Mathew Hauer, Jeffrey Beauvais, Wenfei Xu, and Ian Spangler. I am also grateful to David Tanner and Greg Wilson at the Carl Vinson Institute of Government and Sara Bronin at the National Zoning Atlas for taking me on as a full-time member of their teams as I finished my studies. My position at the Institute of Government, in particular, allowed me to stay enrolled in my degree program, and it gave me the time and space to vastly improve my technical skillset. Without this experience, it is doubtful that I could have finished this work. I also express my sincere appreciation for the many other mentors I had throughout my post-secondary education, especially Rob Yarbrough, Wei Tu, Jill Stackhouse, Nicholas Nagle, Stephanie Bohon, Madhuri Sharma, and Mark Welford, who convinced me to major in geography during my first semester in college.

Last, I thank my family for their love and support throughout my education. I thank my parents, Paul and Lori, and my sisters, Jena and Shannon, for always encouraging my curiosity and supporting my endeavors, which led me to pursue a graduate education in the first place. I also extend my gratitude to the Flores family, especially Gina, for accepting me into their home and always making me feel like part of the family. Many pages in this dissertation were written in the Flores house. Finally, I express my deepest appreciation to my wife Pam for her love, patience, and support throughout this journey. Without her reinforcement, this undertaking would not have been possible.

TABLE OF CONTENTS

Page

LIST OF TABLES

Page

LIST OF FIGURES

Page

CHAPTER 1

INTRODUCTION

One of the most profound economic, political, cultural, and geographical transformations in the history of the United States was the postwar overinvestment in suburbs and concomitant disinvestment in urban centers. The co-production of prototypically white middle- and upper-class suburbs and Black urban spaces solidified new meanings of race and property (Roediger, 2005; Freund, 2007; Lipsitz, 2011; Bonds, 2019), exacerbated racial wealth inequality (Massey and Denton, 1993; Oliver and Shapiro, 1995; Coates, 2014; Rothstein, 2017), propelled global capitalism out of the Great Depression (Walker, 1981; Harvey, 1982), and planted the seeds for later rounds of racialized accumulation and devaluation that erupted in the 2007–08 financial crisis (Dymski, 2009; Wyly *et al.*, 2012; Taylor, 2019). Underpinning this dramatic spatial reorganization was what Charles Abrams (1955, p. 158) called the "racist theory of value" (RTV). The RTV, he described, was the widely held conviction among "the real estate fraternity" (*ibid*.) that a neighborhood's home values were highly contingent on—if not determined by—its racial composition. Devaluation, Abrams recognized, was presumed by real estate capital to be embodied by racially devalued people.

Abrams noted two major implications of the RTV in his time. First, it produced the attachment between non-white residential presence—and especially Black presence—and property value decline that its adherents purported to observe. This was because its

logic is circular. Since appraisers believed Black presence was detrimental to property values, they lowered their appraisals on homes in Black neighborhoods and inflated them in white neighborhoods, effectively making the theory true (Abrams, 1955; Freund, 2007; Howell and Korver-Glenn, 2018, 2021; Bonds, 2019; Zaimi, 2020). Second, the RTV provided a respectable, scientific sheen to segregationist policy, positioning racial exclusion as the obvious solution to combat property value decline in an area (Gotham, 2002; Hornstein, 2005; Freund, 2007; Glotzer, 2020). If devaluation is attached to Black people, Abrams argued, it follows that the aim of policy should be to maintain the neighborhood color line via restrictive covenants, redlining, racial steering, and the like. The implementation of these policies by myriad government and private institutions simultaneously ossified emergent patterns of residential segregation in cities across the US and further strengthened the actual, measurable connection between race and home values that remains an essential feature of the US housing market (Bonds, 2019; Taylor, 2019; Markley *et al.*, 2020; Howell and Korver-Glenn, 2021; Imbroscio, 2021).

The primary argument of this dissertation is that the RTV was a key innovation for managing the geographies of devaluation in racial capitalism. Beyond demarcating spaces for dispossession and predatory extraction, the RTV ensures that the economic costs of continued accumulation—*i.e.*, devaluation—are felt most acutely by people living in Black residential spaces, who are, by definition, predominantly Black. In this way, the RTV constitutes a form of *planned spatial obsolescence* wherein the restricted movement of Black people is converted into the controlled movement of devaluation.

The RTV serves a vital stabilizing function in racial capitalism in three main ways. First, it hastens devaluation in areas that transition from white to Black, effectively

freeing the capital in that place to go elsewhere. In this capacity, the RTV helps facilitate an *anti-spatial fix*. Second, the RTV ensures that a large share of the costs of capital accumulation are concentrated and contained in Black and other predominantly non-white neighborhoods, undermining Black homeowner-based wealth while underpinning white homeowner-based wealth. And finally, for the real estate industry in particular, the RTV's elevation to common practice in the 1930s helped impose much-needed order and predictability onto a home value landscape that had been decimated in the Great Depression.

I build the theoretical scaffolding for this argument in Chapter Two by reading the RTV through Cedric Robinson's (2000 [1983]) theory of Racial Capitalism and David Harvey's (1982, 2017) notion of "anti-value."[1] In short, Racial Capitalism holds that racism is an embedded feature of capitalism, shaping fundamental capitalist processes like accumulation, dispossession, devaluation, and uneven development. Or, as Jodi Melamed (2015, p. 77) puts it, "racism enshrines the inequalities that capitalism requires." And anti-value, Harvey explains, is the negation of value essential to the accumulation process. Since value is, by definition, relational, anti-value entails the loss of value through—among other things—the geographically uneven production of obsolescence. To bring these threads together, I draw on the rapidly expanding body of work that elaborates the interlinkages between race, space, and real estate in racial capitalism, epitomized by Keeanga-Yamahtta Taylor's (2019) *Race for Profit* and Adam Bledsoe and Willie Jamaal Wright's (2019) "The anti-Blackness of global capital."

[1] To differentiate racial capitalism as a political economic system from Racial Capitalism as theory, I capitalize the latter.

Positioning the RTV within the broader context of racial capitalism allows me to elaborate its role in guiding uneven development at the sub/urban scale in the US. However, still lacking are the empirics to demonstrate what this has looked like in practice. Current accounts of how the RTV was enshrined in modern real estate practice do not provide these empirics. In fact, they provide little detail about what the RTV's implementation looked like at all. The main evidence that the RTV was a conscious creation has come nearly entirely from a series of disconnected excerpts from early twentieth-century textbooks, industry pamphlets, and government policy documents, or from *recent* statistical analyses of home price and racial composition. Yet, to argue that the RTV has been crucial for structuring the co-constituted geographies of race and (anti-)value requires more. It requires an in-depth analysis of how race and home values have been linked through time and across space and an account of the RTV being put into action at the neighborhood level.

To pursue these empirical investigations, I turn to the Residential Security maps (see **Figure 1.1**) and accompanying Area Description sheets (see **Figure 1.2**) produced in the late 1930s and early 1940s by the Home Owners' Loan Corporation's (HOLC). This project—officially called the City Survey program—was part of a massive federal effort to survey, map, grade, and collect data for thousands of urban residential neighborhoods in hundreds of cities across the US (Jackson, 1980; Hillier, 2003a). Having recently been digitized by the University of Richmond's Digital Scholarship Lab (Nelson *et al.*, 2022), these archival documents offer unparalleled insight into how real estate capital viewed and produced space. In particular, they reveal how agents of real estate capital assessed a variety of neighborhood-level factors—including racial composition, housing age and

condition, proximity to dis/amenities, income composition, and the like—to assign areas a risk grade on an A-to-D scale.

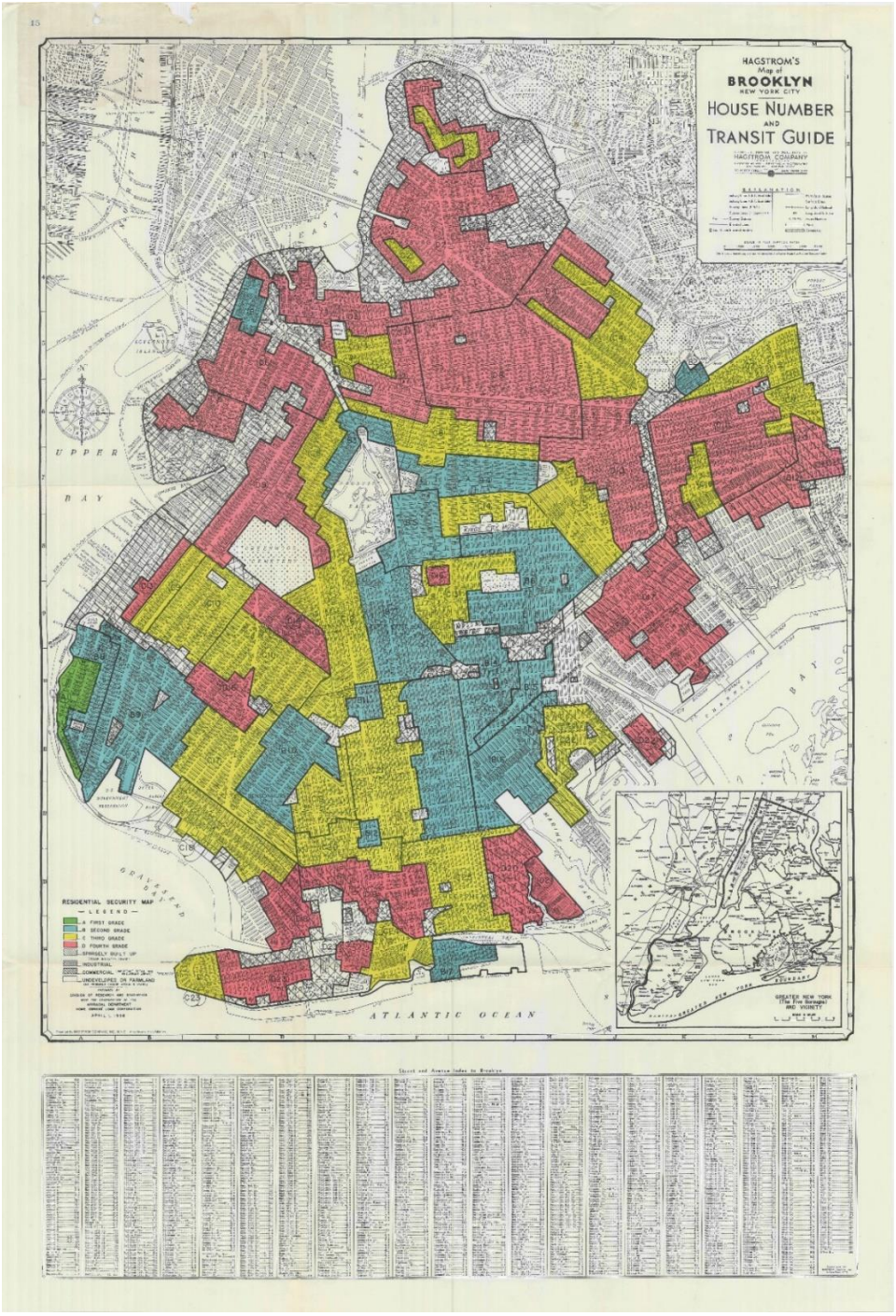
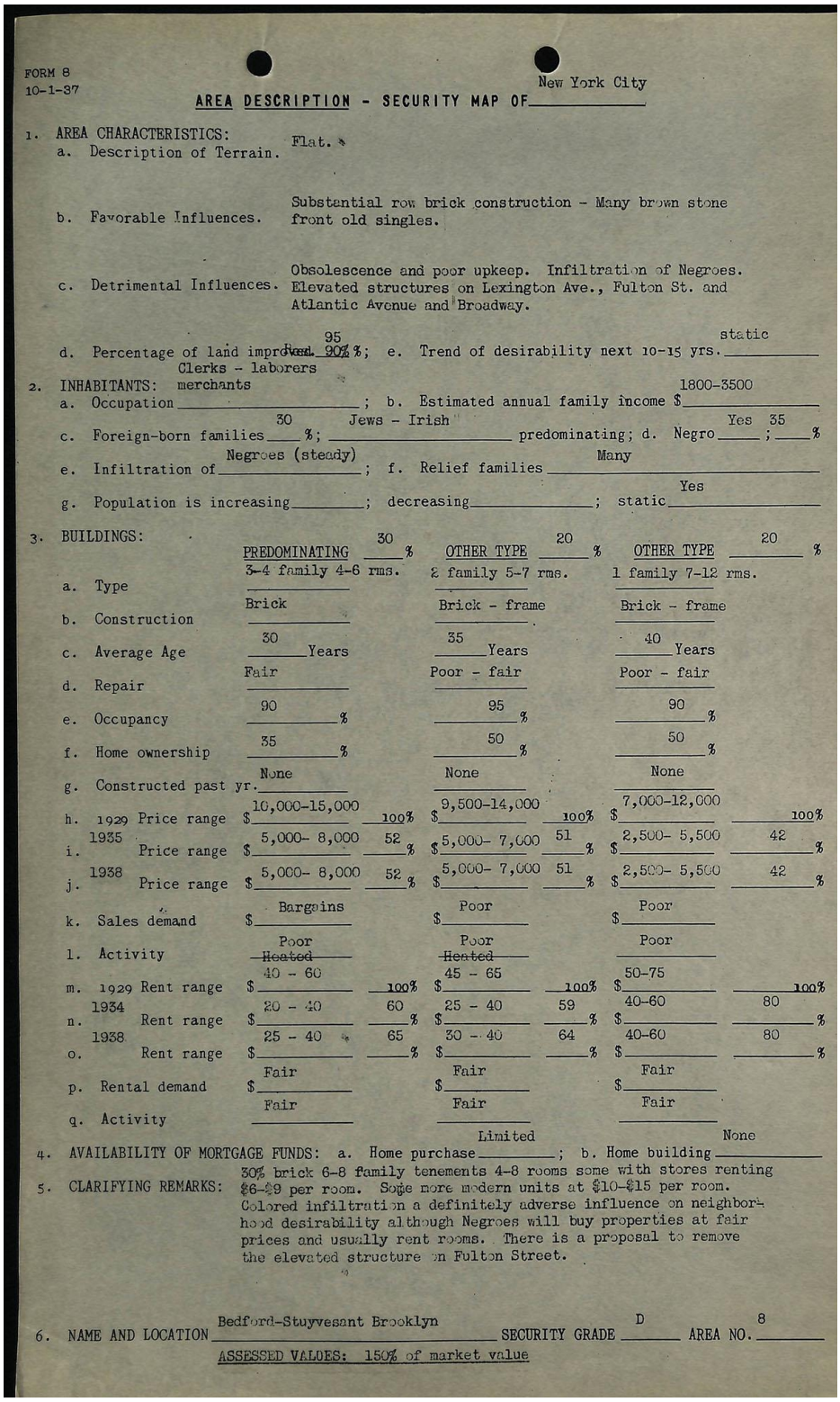


Figure 1.1. HOLC Residential Security Map for Brooklyn, NY. Source: Nelson et al. (2022).



FORM 8
10-1-37

New York City

AREA DESCRIPTION - SECURITY MAP OF _____

1. AREA CHARACTERISTICS:
   a. Description of Terrain. Flat.
   b. Favorable Influences. Substantial row brick construction - Many brown stone front old singles.
   c. Detrimental Influences. Obsolescence and poor upkeep. Infiltration of Negroes. Elevated structures on Lexington Ave., Fulton St. and Atlantic Avenue and Broadway.
   d. Percentage of land improved 95 90%; e. Trend of desirability next 10-15 yrs. static
2. INHABITANTS: Clerks - laborers
   a. Occupation merchants; b. Estimated annual family income $1800-3500
   c. Foreign-born families 30 %; Jews - Irish predominating; d. Negro Yes 35 %
   e. Infiltration of Negroes (steady); f. Relief families Many
   g. Population is increasing _____; decreasing _____; static Yes

3. BUILDINGS:

	PREDOMINATING 30 %	OTHER TYPE 20 %	OTHER TYPE 20 %
a. Type	3-4 family 4-6 rms.	2 family 5-7 rms.	1 family 7-12 rms.
b. Construction	Brick	Brick - frame	Brick - frame
c. Average Age	30 Years	35 Years	40 Years
d. Repair	Fair	Poor - fair	Poor - fair
e. Occupancy	90 %	95 %	90 %
f. Home ownership	35 %	50 %	50 %
g. Constructed past yr.	None	None	None
h. 1929 Price range	$10,000-15,000 100%	$9,500-14,000 100%	$7,000-12,000 100%
i. 1935 Price range	$5,000- 8,000 52 %	$5,000- 7,000 51 %	$2,500- 5,500 42 %
j. 1938 Price range	$5,000- 8,000 52 %	$5,000- 7,000 51 %	$2,500- 5,500 42 %
k. Sales demand	$ Bargains	$ Poor	$ Poor
l. Activity	Poor ~~Heated~~	Poor ~~Heated~~	Poor
m. 1929 Rent range	$40 - 60 100%	$45 - 65 100%	$50-75 100%
n. 1934 Rent range	$20 - 40 60 %	$25 - 40 59 %	$40-60 80 %
o. 1938 Rent range	$25 - 40 65 %	$30 - 40 64 %	$40-60 80 %
p. Rental demand	$ Fair	$ Fair	$ Fair
q. Activity	Fair	Fair	Fair

4. AVAILABILITY OF MORTGAGE FUNDS: a. Home purchase Limited; b. Home building None
5. CLARIFYING REMARKS: 30% brick 6-8 family tenements 4-8 rooms some with stores renting $6-$9 per room. Some more modern units at $10-$15 per room. Colored infiltration a definitely adverse influence on neighborhood desirability although Negroes will buy properties at fair prices and usually rent rooms. There is a proposal to remove the elevated structure on Fulton Street.
6. NAME AND LOCATION Bedford-Stuyvesant Brooklyn SECURITY GRADE D AREA NO. 8

ASSESSED VALUES: 150% of market value

Figure 1.2. Area Description sheet sample for neighborhood D-8 (Bedford-Stuyvesant) in Brooklyn, NY. Source: Nelson et al. (2022)

HOLC's field agents, who were mainly comprised of private lenders and real estate brokers that worked on contract for the agency (Michney, 2022), also included detailed notes about which of these factors they believed to be either favorable or detrimental for the area's future. Their prognosis, I will detail, was largely contingent on which trajectory they believed property values would follow in the near term. As **Figure 1.2** shows, the estimated Black proportion of the neighborhood population was one of the factors field agents considered. And one study found that out of the dozens of majority-Black HOLC neighborhoods across the country, all but six received the lowest grade (D), which is colored red on the map (see **Figure 1.1**) (Winling and Michney, 2021).

The HOLC maps have been the subject of debate in recent years. Although they continue to be employed as an example of how the federal government instituted the practice of redlining and entrenched racial-spatial inequities, mounting evidence suggests they were never actually used to inform lending decisions directly. Still, the body of work interested in these maps continues to revolve primarily around efforts to determine if and to what degree these maps shaped future geographies of racial segregation, economic decline, and other forms of ongoing socio-spatial inequality. These efforts have most often involved heavy quantitative work aiming to reveal what factors *really* determined the neighborhood grades or to estimate the *actual* effects of the maps on the landscape. Though important for their own purposes, these investigations have taken place largely in response to one another in a fairly constricted arena. Further, they have yet to seriously acknowledge the near certainty that the maps were never actually referenced by lenders to any consequential degree. Accordingly, much of the intellectual energy has been steered toward rehashing a limited set of slightly revised—and frankly outmoded—

research questions. This has narrowed how the HOLC maps have been discussed and understood and has left a number of potentially illuminating avenues unexplored.

My secondary aim in this dissertation is therefore to extend the boundaries of the discussion on HOLC risk maps. I do this in five overlapping ways. First, I no longer treat the HOLC maps simply as self-fulfilling prophecies as they so commonly are. I instead consider what the maps can tell us as objects that were, in all likelihood, never actually used for redlining. To do this, I approach the maps and their notes as windows into the governing racial-spatial ideology of real estate capital at the time. This at once places our understanding of the maps in accordance with the historical record and endows them with the historical weight they deserve. By treating the maps as mere cartographic references, the dominant HOLC literature has *underestimated* their significance by assuming their influence has been confined to the areas depicted in them. But by approaching the maps and notes as reflective rather than prescriptive, they can be read more appropriately as cartographic narratives that demonstrate how real estate capital viewed and produced value in space generally, in the places where the maps were drawn and beyond. By taking this approach, we can better learn how the RTV was carried out in practice.

Second, HOLC scholars have thus far almost exclusively focused on the neighborhood grades depicted on the maps themselves. However, the maps cannot satisfactorily be interpreted apart from their attached Area Description sheets because these field notes provide crucial descriptive and quantitative information about the places being mapped. I therefore treat the maps and their accompanying field notes as a unified data product. That is, I do not regard the map grades as the essential output of the City Survey program but as one part of a larger whole. One challenge with this approach is

that while the geocoded map boundaries have been made widely accessible by the Digital Scholarship Lab, the notes remain trapped in either scanned images or unintelligible text strings. Thus, I dedicate Chapter Four to transforming the Description sheet variables into machine-readable tables, allowing easier integration of the notes and map boundaries.

Third, most studies about the HOLC maps have, perhaps understandably, directed their attention to "redlined" (*i.e.*, D) neighborhoods. Yet, these areas made up only a small fraction of the urban places covered by the City Survey Program, and recent research has found that postwar differences in the racial and socioeconomic characteristics between B and C neighborhoods have often been more pronounced than those between C and D neighborhoods (Aaronson, Hartley and Mazumder, 2021). Moreover, large swaths of the urban landscape received no grade from HOLC appraisers but nonetheless contained residents (see Howell, 2015). Addressing these conspicuous omissions, I treat all four grades as equally capable of providing useful information about how field agents understood value in space. In fact, I approach the grades as relationally constructed, such that what is written in the notes about one grade is regarded as though it contains vital clues about how the other grades in that city were assigned. This relational approach, which I elaborate in Chapter Five, is crucial for this study because the RTV is itself a relational construction.

Fourth, studies overwhelmingly treat the map grades as static representations of space that rank areas from "best" to "worst" from the perspective of property owners. However, even a cursory review of the Area Description sheets reveals that appraisers—in line with dominant understandings of neighborhood trajectories of the time—clearly thought of values embedded in space as dynamic rather than static (Stuart, 2003). The

notes, for example, include spaces for agents to remark on observed "infiltration," population changes, rent and home price trends, and the projected trend of desirability, and early iterations of the neighborhood grade labels suggest temporality (*e.g.*, "Still Desirable" and "Definitely Declining"). Better predicting neighborhood racial and value changes through time was, I argue, a main purpose of the City Survey Program in the first place. Therefore, in my analysis, I regard HOLC neighborhood grades as spatial *and* temporal categories. Yellow-lined areas, for instance, were not necessary thought of as places that are slightly "better" than D areas from the perspective of appraisers but were often considered places in the process of becoming like D areas.

Finally, most spatial analyses of the HOLC grades implicitly treat them as uniform categories. However, for my analysis of the RTV, I break from this common assumption and instead emphasize the considerable internal variability within map grades. This move is necessary for two reasons. First, no evidence suggests that the map grades were ever meant to be interpreted uniformly. On the contrary, as I elaborate, HOLC appraisers routinely commented on how some areas or populations within a particular grade were better suited for investment than others. Second, since the HOLC literature has made D-graded neighborhoods their point of focus rather than the RTV, I cannot simply rely on their findings to argue that Black neighborhoods have been devalued through time. I must also show why the relationship between race and home values alone supersedes the relationship between race or home values *and HOLC grade*. This move requires that I highlight intra-grade difference.

Layout of the Dissertation

With this groundwork laid, I pursue my objectives across five chapters plus a conclusion and a set of appendices separated into three sections: Theoretical Background, Data Preparation, and Empirics. Each of these chapters is designed to read both as part of a coherent whole and as standalone article. Chapters Two and Three comprise the **Theoretical Background** section. Chapter Two focuses on the RTV, positioning it within the broader literature around racial capitalism and urban political-economic geography. As part of that effort, I argue that while much of the work theorizing race, space, and real estate in racial capitalism has emphasized dispossession, devaluation as such merits equal consideration. I contend that through real estate capital's efforts to attach value to white presence and anti-value to Black presence, the RTV has served a vital function in capitalism by demarcating, containing, and controlling devaluation in Black spaces.

In Chapter Three, I turn to the ongoing debates surrounding HOLC's City Survey program. Here, I trace the contours of these debates and propose a new approach to studying the maps and their field notes. In outlining this literature, I find that most work can be classified into two competing camps. The dominant camp, which I call "HOLC Culpablism," emanates from the work of Kenneth Jackson (1980, 1985) and broadly holds that the HOLC maps played an important role in shaping future geographies of racial housing segregation. The minority camp, which I call "HOLC Skepticism," comes from Amy Hillier's (2003a, 2003b, 2005b, 2005a) rebuttals to Jackson, and it rejects the Culpable argument on several counts. Finding these positions to have run up against their self-imposed limitations, I propose a research agenda that reads the HOLC mapping program through the lenses of Racial Capitalism and critical cartography.

Chapter Four comprises the **Data Preparation** section. Here, I clean and tabulate HOLC's Area Description sheet variables, making them available for multi-city analyses. With this dataset—which has been published in *Environment and Planning B* (see Markley, 2023)—users can examine the racial composition, housing age, household income, occupational class, and mortgage availability for thousands of HOLC neighborhoods across over one hundred cities. Additionally, in this chapter, I provide data visualizations and summary statistics illustrating the racial, socioeconomic, and housing characteristics of HOLC grades by region. The data cleaned in this section is then used in the remaining two chapters.

Section III is the **Empirics** section, and it includes Chapters Five and Six. In Chapter Five, I investigate how the RTV was put into action at the neighborhood level. To do this, I explore the highly detailed cartographic narratives told throughout the HOLC maps and field notes in two cities: Milwaukee, Wisconsin and Atlanta, Georgia. For this task, I outline a methodological approach that combines aspects of critical cartography and narrative inquiry before applying that framework—which I call critical narrative cartography—to assess how HOLC field agents narrated the relationship between race and value in space and time. I identify two major narratives of value in the two cities' notes. The first, which I call "Temporal Narratives," places neighborhoods along a temporal value trajectory, using recent trends within the neighborhood to predict future values. The second, which I call "Proximity Narratives," places neighborhoods on a spatial plane, using nearby developments outside the neighborhood to do the same. Race, I discover, features prominently in these separate but complementary narrative

types, albeit in different ways in each city. Together, these cartographic narratives of race and value reveal a RTV in formation.

In Chapter Six, I challenge the rapidly growing body of work I call "Quantitative Culpablism." This scholarship is characterized by a collection of quantitative spatial analyses that overlay HOLC grade boundaries on top of present-day social injustices to suggest that the former caused the latter. I argue that beyond relying on the unsubstantiated assumption that the HOLC maps were actually used by private lenders and/or the Federal Housing Administration (FHA), this literature's fixation on the map grade boundaries has downplayed the power of the RTV in producing racialized devaluation. To demonstrate this, I conduct two sets of statistical analyses. The first finds that postwar Black urban population growth did not occur in HOLC "redlined" areas generally as it is often assumed. Rather, it was most concentrated in those areas that either had an initial Black population or that were adjacent to them. The second set of analyses finds that since 1980, a neighborhood's Black population share has been a more salient predictor of home prices than its HOLC grade assignment. Thus, if the aim is to illustrate how past and present racial injustices continue to reproduce racial-spatial inequities, I propose that scholars focus on racial residential segregation directly rather than by way of a circuitous analysis of HOLC grades.

The data I use in Chapter Six require a significant amount of preparation. I therefore provide two methodological appendices outlining how I produce housing, population, race, and socioeconomic data in consistent census tract geometries. The first, Appendix A, outlines a multi-method data interpolation procedure I develop to generate housing unit and urbanization estimates in 2010 tract vintages for each decade from 1940

to 2010 plus 2019. This open-access dataset—called the Historical Housing Unit and Urbanization Database v2010 (HHUUD10)—allows users to examine ninety years of housing unit loss and gain, urban renewal, land-use change, and sub/urbanization for over seventy-thousand census tracts across the entire Continental US. This chapter originally appeared in *Nature*'s *Scientific Data*, and it was coauthored with Steve Holloway, Taylor Hafley, and Mathew Hauer (see Markley *et al.*, 2022).

Appendix B employs HHUUD10 data to generate historical population, housing, race, and monetary variables in 2010 census tract geometries. These are also leveraged in the analyses in Chapter Six. Specifically, these variables allow me to trace historical changes in my two variables of interest—median home value and Black population percentage—as well as a series of controls at the tract level. The latter include vacancy rates, homeownership rates, and median household incomes. As part of this appendix, I develop a new procedure I call "Racial Occupancy Weighting," which uses historical occupancy by race data from the Census to improve tract-level estimates of racial composition.

I conclude this dissertation in Chapter Seven by linking HOLC's City Survey program and a contemporaneously published monograph written by FHA official Homer Hoyt (1939) with Zillow's recent failed efforts to automate home buying and selling. In reflecting on the persistent desire of real estate capital to predict home values, I consider the RTV as a creature of early housing data science. With this in mind, I revisit my findings from Chapters Five and Six, elaborating on what they suggest for how we situate the HOLC maps and notes in anti-racist scholarship.

SECTION I

Theoretical Background

CHAPTER 2

RESIDENTIAL SEGREGATION AND THE RACIST THEORY OF (ANTI-)VALUE[2]

[2] Markley, Scott. To be submitted to *Environment and Planning D: Society and Space*.

Abstract

In recent years, there has been an outpouring of urban geographical research exploring the linkages between race, real estate, and space in racial capitalism. Among the most consequential have been Keeanga-Yamahtta Taylor's (2019) *Race for Profit* and Bledsoe and Wright's (2019) "The anti-Blackness of global capital." Drawing from related but distinct academic traditions, both position space and the discursive devaluation of Black people at the center of their analyses. In doing so, they open the door for a critical reinterpretation of residential segregation as crucial for structuring the geographies of capital accumulation. In this chapter, I build from the foundations they lay by bringing together Charles Abrams' concept of "the racist theory of value" and David Harvey's spatial rendering of Marxian value theory to develop the contours of this argument. Specifically, I contend that the racist theory of value, in its role in entrenching residential segregation and collapsing race and value together in space, helps to demarcate and contain the devaluation that capitalism requires in Black residential spaces. Among other consequences, this arrangement ensures that the economic losses generated by the accumulation process are felt most acutely in Black communities.

"Dear God! Must we not live? And if we live may we not live somewhere? And when a whole city full of white folk led and helped by banks, Chambers of Commerce, mortgage companies and 'realtors' are combing the earth for every decent bit of residential property for whites, where in the name of God can we live and live decently if not by these same whites? ... But, wail the idiots, Negroes depress real estate values! This is a lie – an ancient and bearded lie. Race prejudice decreases values both real estate and human."

- W.E.B. DuBois (1925), "The Challenge of Detroit," *The Crisis*

Introduction

In his 1955 book, *Forbidden Neighbors*, Charles Abrams introduced the phrase "the racist theory of value" to describe a central tenet of the real estate industry in the United States. As he put it, the "real estate fraternity" believed that "just as bad dollars drive out good ones, so do bad people of the wrong complexion or status drive out good people and depress neighborhood values" (1955, p. 158). In this view, which Abrams charts through numerous industry and government documents, property value decline and "blight" result not only from physical deterioration as it was often assumed, but are delivered to an area by the people who move there. Devaluation, he recognized, was presumed by real estate capital to be embodied by devalued people.

In this chapter, I argue that the racist theory of value (RTV) has profound implications for understanding residential segregation in racial capitalism. In particular, it suggests that the racially discriminatory housing policies and practices that have continually reproduced residential segregation have not only structured the geographies of predatory extraction, as Keeanga-Yamahtta Taylor (2019) and others have recently

demonstrated (*e.g.*, Bledsoe and Wright, 2019; Zaimi, 2020, 2022; Fields and Raymond, 2021; Purifoy and Seamster, 2021), but have also worked to concentrate, delimit, and contain the devaluation that is required for accumulation to continue apace. The RTV thus plays a vital stabilizing role in racial capitalism beyond designating spaces for dispossession and extraction. By attaching value to some people and neighborhoods and "anti-value" (Harvey, 2017) to others, it provides a way to both plan and mobilize obsolescence on the sub/urban housing landscape. In doing so, it has helped generate and demarcate a racially uneven geography of (anti-)value that has helped facilitate the movement of capital through space, while concentrating loss in racially devalued spaces.

To build my argument, I proceed in three sections. The first traces the development and spread of the RTV during the twentieth century among a deeply entwined network of real estate capitalists, government agencies, academics, and professional organizations. The second details how recent scholarship has theorized the RTV within the framework of Racial Capitalism. As I outline, the primary focus has been on how the RTV has enabled racialized extraction and dispossession. To complement this body of work, I propose an additional focus on devaluation by reading the RTV through Harvey's (2017) notion of "anti-value" in the following section. There, I theorize the role of the RTV in producing an "anti-spatial fix."

The Rise of the Racist Theory of Value

The invention and spread of the RTV has been fairly well documented. Its origins in the US are often traced to the National Association of Real Estate Boards (NAREB), which was the country's first major professional organization and lobbying arm of the

real estate industry (Hornstein, 2005; McCabe, 2016; Glotzer, 2020).[3] Established in 1908, NAREB was an early advocate of adopting racially restrictive covenants as a way to protect home values against apparent racialized devaluation (*ibid*., see also Gotham 2002). From the late 1910s to the 1940s, NAREB distributed its own journal that was largely dedicated to the task of legitimizing the real estate profession. In this effort, journal contributors sought to standardize home appraisal techniques, which were being revolutionized by the nascent fields of "appraisal science," land-use economics, and so-called "realology"—purported to be the science of real estate—in the 1920s and 1930s (Stuart, 2003; Hornstein, 2005; Woods, 2012; McCabe, 2016; Glotzer, 2020; Zaimi, 2020). A central theme in this work was an emphasis on the then-novel approach of taking neighborhood-level social characteristics—including racial composition—into account when assessing home values (Hillier, 2005a; Woods, 2012). NAREB codified this commitment to residential segregation in service of the RTV in Article 34 of their 1924 *Code of Ethics*:

> A Realtor should never be instrumental in introducing to a neighborhood a character of property or occupancy, members of any race or nationality, or any individual whose presence will clearly be detrimental to property values in that neighborhood. (National Association of Real Estate Boards, 1924)

[3] Nightingale (2012) identified a nascent RTV in British colonial settlements in India, Hong Kong, and South Africa, but argues that it was a secondary motivation for segregation behind concerns about military strategy, political control, and sanitation. As he documents, the RTV solidified as the economic expression of these anxieties and others, including crackpot fears in the US about how residential "race mixing" would inevitably lead to racial violence and miscegenation.

This article, Abrams (1955) notes, remained official NAREB policy until 1950, two years after the US Supreme Court outlawed racially restrictive covenants. And it was not entirely confined to NAREB's internal documents. As Zaimi (2020, p. 1552) points out, similar language spread to the NAREB-affiliated American Institute of Real Estate Appraisers (AIREA), which stated in its 1948 *Handbook for Appraisers* that "neighborhood infiltrations of inharmonious people" was one cause for economic obsolescence.

Although NAREB was a major proponent of the RTV, it was but one node in a much larger network of affiliated academics, private organizations, and government agencies. NAREB's emphasis on considering neighborhood-level social factors in making property value determinations came directly from the work of pathbreaking urban land economist, Richard T. Ely (Winling and Michney, 2021). Ely worked closely with the organization, and two of his most renowned students—Arthur Mertzke and Ernest Fisher—would even direct NAREB's research division before taking high-ranking positions in the administrations of Herbert Hoover and Franklin Roosevelt, respectively (Weiss, 1989). Dozens of other graduates from Ely's urban land economics research institute would take other leadership roles within the New Deal government, provide consulting for private lenders, or do both (*ibid*.). Their expertise was especially sought during the Great Depression because many in positions of power believed the conditions that led to the Depression's housing crash could be overcome by applying a more scientific, data-driven appraisal standard (Freund, 2007; Woods, 2012; Glotzer, 2020; Zaimi, 2020).

Recognizing that neighborhood factors affected property values was an important precursor to formalizing the RTV. Abrams (1955) documented many instances of the RTV appearing in real estate textbooks from the 1920s through the 1940s alongside this emergent emphasis on neighborhood influences. Much of the early focus was on ethnically diverse immigrant neighborhoods, but the attention shifted to Black residents, he found, "about the time the Negro migrations to the North increased" (Abrams, 1955, p. 158). Supporting this finding, Abrams cited an authoritative 1923 textbook, which argued that Black residents moving north "naturally [had] a decidedly detrimental effect on land values" because "few white people, however inclined to be sympathetic with the problem of the colored race, care[d] to live near them" (p. 159). The "reasonable solution," the authors proposed, was to enforce the "[s]egregation of the Negro population…no matter how unpleasant or objectionable the thought may be to colored residents" (*ibid*.).

Abrams also drew attention to the work of scholar-bureaucrats that helped elevate the RTV to common practice. One was Homer Hoyt, who served as the Federal Housing Administration's (FHA) chief land economist in the latter half of the 1930s. In 1933, he published a book-length empirical study out of his dissertation about historical land values in Chicago. In it, Hoyt (1933 [1970], p. 314) argued that some "racial and national groups…*cause* a greater physical deterioration of property than groups higher in the social and economic scale" (emphasis added). He then provided a ten-tier list ranking racial and ethnic groups by their supposed effect on property values, from "most favorable" to "most detrimental" (p. 316). The top spot was a tie among several northern and western European groups, while the bottom three spots belonged to "South Italians," "Negroes," and "Mexicans," respectively (Hoyt, 1933 [1970], p. 314). Hoyt suspected

that "racial prejudice" may be a driving force—as DuBois (1925) had argued eight years earlier—but he ultimately discounts this suspicion because whatever one might think of prejudice, the fact of the matter to him was that "such dislikes are reflected in property values" (*ibid*.). Indeed, a large part of the RTV story is about practitioners recognizing that home values are "reflective of, and constituted by, prevailing social values and biases" (Imbroscio, 2021, p. 32), and then working to ensure those social values stay intact by building them into their appraisal models.

Hoyt's FHA colleague, Frederick Babcock, was another prominent proponent of the RTV. In his widely read 1932 textbook, *The Valuation of Real Estate*, Babcock (1932, p. 89) emphasized the temporal quality of value, stating that property value decline was "inevitable in all residential districts."[4] Over time, he added,

> [A]ll such areas become decadent districts or slums occupied by the poorest, most incompetent, and least desirable groups in the city. Ragged urchins play on marquetry floors. (*ibid*.)

To illustrate his temporal conception of value, he included two graphs—depicted in **Figure 2.1**—showing alternative scenarios. The first is a residential district that receives reinvestment from a more intensive, different land use. The second is the more common situation, where no new development comes:

[4] Babcock was also an academic colleague of Ely-trained Ernest Fisher at the University of Michigan's School of Business Administration, and thanked him twice for his support in the acknowledgment section of *The Valuation of Real Estate*.

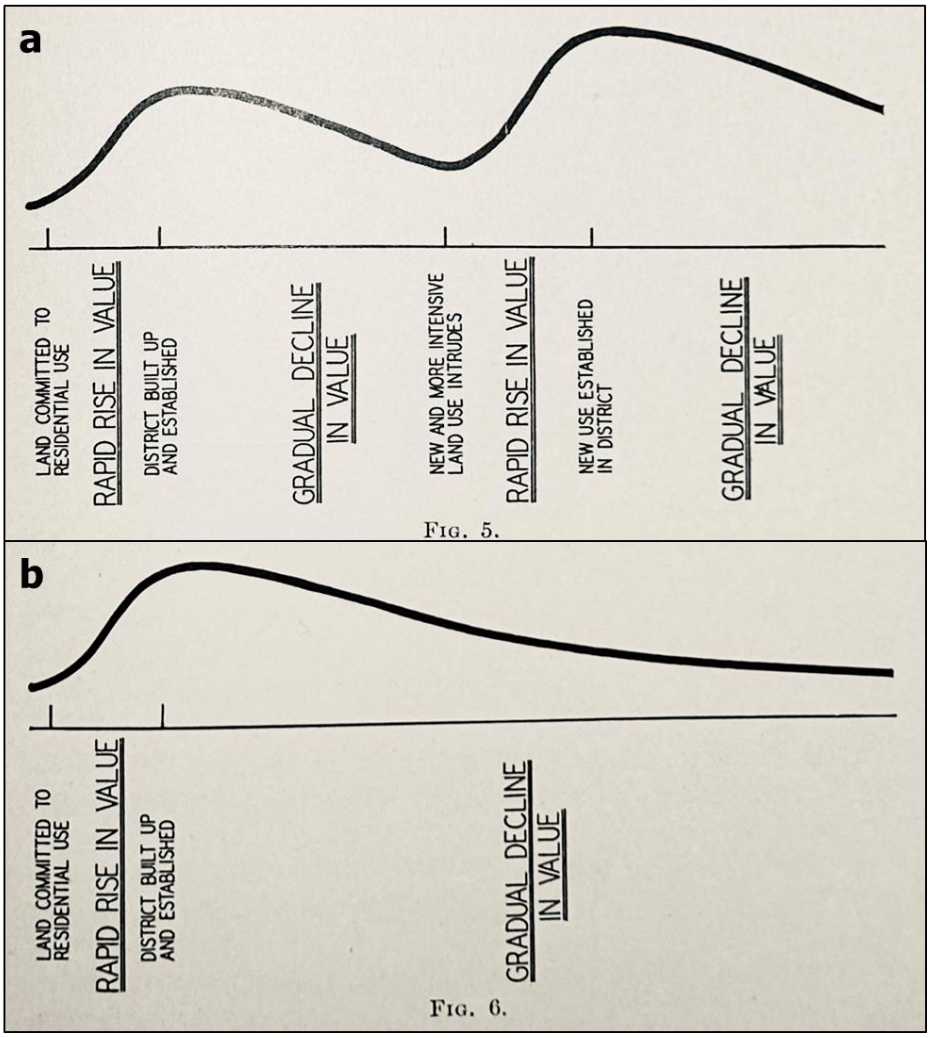


Figure 2.1. Graphs from Figures 5 (a) and 6 (b) on page 87 of Frederick Babcock's (1932) The Valuation of Real Estate. *Permission to reproduce these graphs was granted by the publisher.*

In both cases, land values are expected to fall gradually over time barring reinvestment. This was, in fact, the foundation for the notion of "filtering," which—in part thanks to the influential career of Ely-trained economist, Ernest Fisher—would become a major foil against expanding public housing during the twentieth century (see Harris, 2012; Teresa, 2022a). Why expend state resources on affordable housing when the free market will provide it after a few years of depreciation? However, Babcock's theory of neighborhood value change came with a notable twist. As he put it:

> Most of the variations and differences between people are slight and value declines are, *as a result*, gradual. There is one difference in people, namely race, which can result in a very rapid decline. Usually such declines can be partially avoided by segregation and this device has always been in common usage in the South where white and negro populations have been separated. (Babcock 1932, p. 91; emphasis added)

Beyond its shocking candor and open support for Jim Crow-style segregation, this excerpt is noteworthy because Babcock directly ascribes property value decline to "differences between people," placing special emphasis on racial differences. That is, for Babcock, racial heterogeneity in itself was a key source of obsolescence, an accelerant that sped up the inexorable aging process. Thus, while there was little anyone could do about an area's negative value trajectory, the *pace* of that journey—*i.e.*, the slope of the lines in **Figure 2.1**—could be controlled by enforcing racial separation. Segregation is proposed as a spatial answer to a temporal problem.

As head of the FHA's Underwriting Division, Babcock incorporated this racial-spatial-temporal notion of value into the FHA's 1938 *Underwriting Manual*. Echoing the language used by AIREA, the document instructs FHA appraisers to score properties in racially diverse neighborhoods lower because the "infiltration of inharmonious racial groups" will "tend to lower the level of land values and lessen the desirability of residential areas" (Federal Housing Administration, 1938, pp. 1358–1360). Here, the RTV was directly transformed from the pages of a textbook to government policy. The result, Abrams (1955) and Jackson (1985) point out, was to render most non-white urban neighborhoods ineligible for government subsidized mortgages following World War II.

Through the home mortgage programs of the FHA and Veterans Administration—which used practically identical standards—millions of Americans were granted access to homeownership, provided that the neighborhoods they moved to were predominated by single-family homes, recently constructed, outside the urban core, and racially homogenous (Jackson, 1985; Rothstein, 2017). Black neighborhoods, by design, met few of these qualifications and were therefore denied this federal subsidy, producing the racialized devaluation that the RTV predicted.

The RTV also appeared in other government documents around this time. Most notably, the Home Owners' Loan Corporation (HOLC) conducted a massive surveying project that contracted scores of private lenders, bankers, and real estate brokers to appraise thousands of urban neighborhoods across the country in the late 1930s and early 1940s. Although the maps and field notes were not directly used by home lenders, they included a patently racist grading schema that penalized Black and other non-white neighborhoods with lower "security" grades (Jackson, 1985; Michney, 2022). The rationale, it seems, was the widespread conviction that these groups—by their very existence in a place—presented higher risks to nearby property owners. Throughout the field notes, HOLC appraisers openly remark on the "detrimental influences" of Black residential presence and expected "infiltration" of other racial, ethnic, and national groups (see **Figure 1.2** in Chapter One), reflecting the ascendancy of the RTV in the private-public real estate blob. Writing contemporaneously in his role as head FHA economist, Hoyt (1939, p. 54) explained this logic in an FHA-published monograph:

> In wholly white areas, the gradual filtration of other than white races tends slowly to change the character of neighborhoods. The presence of even

> one nonwhite person in a block otherwise populated by whites may initiate a period of transition. The proportionate concentration of nonwhite persons in each block is therefore significant in any study of rent gradations…In some cities, rents in wholly white blocks adjacent to wholly or partially nonwhite blocks may also be affected.

By the 1950s, federal agencies like the FHA and professional organizations like NAREB and AIREA were scrubbing pro-segregationist language from their official documents. Yet, the RTV continued to be broadly considered an essential reality of the housing market. The extent to which the RTV had entered popular conceptions about home values was captured succinctly in a 1957 *Life* magazine article covering the move of the Myers family into Levittown, Pennsylvania. With construction starting in 1952, this sprawling, mass-produced housing development contained over 17,000 nearly identical ranch-style homes on single-family lots (Harris, 2010). After the developers' multi-year crusade to keep the planned community all-white, William and Daisy Myers—a Black couple—bought a house in Levittown in 1957, sparking an immediate backlash from their white neighbors. When asked his opinion of William Myers by a *Life* reporter, one Levittown resident said, "He's probably a nice guy, but every time I look at him I see $2,000 drop off the value of my house" (cited from Cohen, 2003, p. 217).

Real estate brokers, too, remained keenly aware of their cities' racial geography. The racial tipping points described by Babcock (1932) and Hoyt (1939) above appeared again in Rose Helper's (1969) interviews with 90 white "real estate men" working on Chicago's South Side. Conducting these interviews in the 1950s, Helper asked her subjects about their experiences working with clients of different races. She observed a

pronounced fixation on what they referred to simply as "the trend." To the "real estate man," Helper (1969, p. 33) wrote, "'trend' has a special sense, referring to the movement of Negroes as they approach and enter white neighborhoods and to what may affect its direction." She continued:

> Real estate men cannot know which way the trend will go or what may happen to send it in a particular direction…Neither can they know whether change in racial occupancy, if it comes, will be slow or fast…Real estate men influence the trend and are influenced by it – some make it their business to anticipate it, or, by soliciting and making a few sales, help to turn it in a certain direction. (*ibid*.)

These brokers, Helper found, monitored "the trend" by keeping track of how close new Black residents were moving to a particular block. The word "trend" connotes time, but for these brokers, it was indicated through time *and* space—namely, the distance, direction, and speed of Black settlement. In efforts to take control of the trend, many of her interviewees claimed they never sold a property to a Black buyer on a block with no other Black households unless, perhaps, they saw racial transition as imminent. However, once one Black resident had moved to an area, they claimed, "you couldn't sell to anyone else" (1969, p. 36). Determining when to sell to Black homebuyers was no small matter. "[W]hen property is transferred from white to Negro hands," they believed, "it is lost to the white group forever" because "white people seldom buy and live in property that has been occupied by Negroes" (Helper 1969, p. 25). Steering and blockbusting were thus the tools of choice for the real estate agent, tools that accepted the RTV as law, that managed and exploited it, that reproduced it.

Federal laws adopted in the late 1960s and 1970s in response to the civil rights movement outlawed racial steering, blockbusting, redlining, and other forms of overt racial discrimination in housing. But the RTV endured. From the 1970s to the 1990s, Black homeowners lost "literally tens of thousands of dollars" due to racially uneven patterns of home price appreciation (Flippen, 2004, p. 1545). Similar findings were replicated across multiple metropolitan contexts in the years leading up to and following the housing crash of 2007–2009 (Charles, 2006; Dickerson, 2014; Perry, Rothwell and Harshbarger, 2018; Markley *et al.*, 2020). One study even found that a neighborhood's racial composition was a more significant determinant of its appraised home value in 2015 than in 1985 (Howell and Korver-Glenn, 2021). Although the dominant approach to real estate appraisal today—the sales comparison method—does not take neighborhood racial composition directly into account, it incorporates it by proxy. Indeed, as Taylor (2019) has argued, it must because the RTV structures the US housing market in racial capitalism.

Race, Space, and Real Estate in Racial Capitalism

In a recent talk, Keeanga-Yamahtta Taylor highlighted a central theme of her acclaimed book, *Race for Profit*. She stated that "the segregated housing market continued [after overt racial discrimination was outlawed] because it was profitable" (in Rockett, 2020). She expounds on this point in the book by theorizing a post-civil rights era transition from "discriminatory exclusion" to "predatory inclusion." Whereas the former was defined by racist laws and practices that denied Black people access to affordable housing, credit, and insurance, the latter has been defined by the inclusion of Black people in these markets on conditional and predatory terms. Crucially, she notes,

profit is extracted from Black neighborhoods in both cases. In discriminatory exclusion, slumlords, contract sellers, and blockbusting real estate agents capitalized on the limited mobility imposed on Black households by exclusionary tactics, including restrictive covenants, redlining, racial steering, and white-led and state-supported violence and intimidation (see also Massey and Denton, 1993; Satter, 2009; Coates, 2014; Rothstein, 2017). In predatory inclusion, those same neighborhoods—established during that previous era and maintained by subtler forms of exclusion—made ideal targets for subprime lenders and other predatory enterprises (see also Dymski, 2009; Hernandez, 2009).

Although Taylor does not explicitly reference Cedric Robinson or racial capitalism in the book, her account fits well within that framing. As Robinson (1983 [2000]) illustrated, racism did not develop within capitalism but has shaped capitalism from the outset. Therefore, essential capitalist processes—such as labor exploitation and expropriation, land appropriation and resource extraction, and accumulation and uneven development—are always-already structured by racism. Jodi Melamed (2015) elaborates on what this entails. For accumulation to exist at all, she points out, some people must be rendered exploitable, expropriable, and disposable, and "racism enshrines the[se] inequalities that capitalism requires" (Melamed, 2015, p. 77). Race, in this framework, is therefore not understood to be an outcome of capitalist processes—as some have suggested—but is instead recognized as "essential to the workings of capitalism and its reproduction over time" (Bonds, 2019, p. 4; emphasis in original). That is, as Melamed (2015, p. 77) puts it, "all capitalism is racial capitalism."

Taylor astutely recognizes an analogous spatial dynamic in the housing market. Just as racial capitalism in general differentially values human life on the basis of race (Gilmore, 2002; Cacho, 2012; Pulido, 2017; Byrd *et al.*, 2018), the racial capitalist housing market differentially values property on the basis of a place's racial character. Hence, there is no "dual market" for housing as it has long been suggested because a "'white housing market' would [be] unintelligible without its Black counterpart" (Taylor, 2019, p. 11). Instead, as Taylor posits, there is a single, dialectically connected market wherein the value of white neighborhoods is derived from their quality of being not-Black (Freund, 2007; see also Bonds, 2019; Markley *et al.*, 2020; Zaimi, 2020, 2022; Imbroscio, 2021). This is the RTV in action.

There are, therefore, two inextricable roles for residential segregation in Taylor's account. First, segregated Black spaces provide areas for profitable extraction. Second and relatedly, segregation makes possible the immense property-based wealth that comprises a substantial share of white wealth in the US. Or, as Purifoy and Seamster (2021, p. 52) put it, "value for white spaces is predicated on the devaluation of Black places." The beneficiaries of this arrangement are institutional and individual property owners, including banks and other mortgage lenders, real estate firms, landlords, investment trusts, and a subset of affluent white homeowners. The primary victims include both homeowners and renters, particularly those living in systemically devalued, segregated spaces, who are, by definition, predominantly nonwhite. By focusing on these two sides of the US housing market, Taylor powerfully undercuts the liberal fantasy of eliminating racial wealth inequality by widening the net of inclusion into a racist homeownership system dependent on that inequality (see also Markley *et al*., 2020).

Focusing on the profitability of segregation, however, only partially captures its centrality to racial capitalism. Expanding the field of vision from meso-scale actors to racial capitalism as a system, Bledsoe and Wright (2019) show that capital accumulation itself depends on space being racialized and Black space being devalued (Loyd and Bonds, 2018; see also Fields and Raymond, 2021). To make this case, they draw from Katherine McKittrick, who argues that the violent and ongoing project of rendering Black people "ungeographic" (2006, p. xiii) casts Black spaces as "the lands of no one" (2013, p. 7). This form of discursive devaluation, Bledsoe and Wright (2019, p. 9) contend, "makes the perpetual accumulation of capital possible" because it frames Black spaces as "empty" and thus always available for appropriation. Therefore, Black populations serve not only as sources of wealth for white institutions as Taylor highlights but "as the guarantor of capitalism's need to constantly find new spaces of accumulation" (p. 12). In this way, Bledsoe and Wright contend, anti-Blackness is a prerequisite for David Harvey's (1981, 1982) notion of the spatial fix because it designates the spaces where dispossession in service of spatial fixity can occur.

Though scaled up, Bledsoe and Wright's account is complementary to Taylor's. While Taylor focuses on the particular institutions profiting from segregation, Bledsoe and Wright show how their pursuit of profit enables the reproduction of capitalism. Read together, they suggest that the racialization of space in general and residential segregation in particular are about delimiting places for potential extraction. This emphasis on extraction has been echoed throughout the rest of the recent boom in sub/urban housing-focused racial capitalism research. For example, Chakravarrty and Ferreira da Silva (2012) and Fields and Raymond (2021) explore the uneven racial dimensions of

"accumulation by dispossession" (Harvey, 2003) in housing finance, while others have highlighted how residential segregation has structured the geographies of predatory profit-making—including rent gouging (Zaimi, 2020, 2022; Crowell, 2022), contract selling (Teresa, 2022b), resource confiscation (Purifoy and Seamster, 2021; Seamster and Purifoy, 2021), gentrification (Cowen and Lewis, 2017; McClintock, 2018; Boston, 2021; Rucks-Ahidiana, 2021), and municipal debt financing (Jenkins, 2021; Ponder, 2021; Kass, Crosby and Parker, 2022). And a closely related body of research has linked these ongoing forms of racialized dispossession in cities with the extractive logics of settler colonialism (Bhandar, 2018; Byrd *et al.*, 2018; Dorries, Hugill and Tomiak, 2019; Kelly, 2022).

All these works presume—and Bledsoe and Wright state outright—that the devaluation of people and spaces is a prerequisite for such extraction. Yet, the emphasis has largely remained on the latter, overlooking the vital role of devaluation as such. Exceptions have come from the environmental racism literature, which has highlighted how the racialized devaluation of space produces "sinks" (Pulido, 2017) to contain the toxic waste generated by capitalist development (see also McClintock, 2011; Pulido, 2016; Purifoy and Seamster, 2021; Seamster and Purifoy, 2021). But even here, Purifoy and Seamster (2021) classify this type of devaluation as a case of extraction. This move is unnecessary, I maintain, because devaluation in itself is both generative of racial-spatial inequities and an immanent feature of accumulation. It is, rather, the opposite of extraction. Rather than taking resources or value from an area, devaluation is about offloading costs onto that area. Or, as Pulido (2016, p. 8) puts it, the "value" of poor people of color and the places where they live is "their general expendability." In this

way, the concept of devaluation has implications that go beyond the environmental. The RTV suggests that residential segregation structures the geographies of devaluation in a broader economic sense as well. To elaborate on what this entails, I turn to where Bledsoe and Wright (2019) left off: the spatial fix.

The Anti-Spatial Fix

As Harvey (1981, 1982) outlines, the spatial fix is a requirement for the continued reproduction of capitalism. This is because the rate at which capital accumulates in a place, by structural necessity, will eventually outstrip the opportunities to reinvest that capital profitably. In other words, there is only so much additional surplus that can be yielded from new capital investments before the obligations on those investments surpass the added returns. The result is a situation which Marx (1867 [1992]) called "overaccumulation." Here, returns fail to reach what was expected (or promised), disrupting the flow of capital through the system and thereby necessitating the devaluation of a portion of capital in circulation (Harvey, 1982). This devaluation manifests as layoffs, shop closures, wage cuts, and fire sales, and if it is large enough, it may precipitate a full-blown economic crisis.

Capitalism, Marx realized, moves inexorably toward overaccumulation. It is therefore imperative for capitalists to find (or create) new outlets for investment, allowing a portion of the over-accumulated capital to be absorbed. Harvey, building from Lefebvre (1970), explicated the role of space in this. As he recognized, such crises of overaccumulation could be temporarily averted when a sizeable portion of capital in surplus was pumped into the built environment. That is, if returns on investment had approached their limit in one place, capital could be rerouted to produce another place.

On the ground, this takes the form of large-scale, debt-financed construction projects that produce new buildings and transportation infrastructure. Postwar suburbanization is the quintessential twentieth-century example in North America (Walker, 1981). But urban renewal, gentrification, and the subprime mortgage bubble provide more recent examples (Wyly, Atia and Hammel, 2004; Hackworth, 2007; Gotham, 2009; Christophers, 2011). All rely on remaking places through massive infrastructural investments that create new outlets for capital absorption.

The spatial fix can and frequently does rely on direct dispossession. This is the point of focus for Bledsoe and Wright (2019). But there is another side of the spatial fix coin. Investments in the built environment, Harvey (1978, 1982) theorized, can only occur by rearranging the relations of value in space. Every new fixed capital investment—in the form of shopping centers, housing developments, highways, warehouse districts, and the like—produces new locational advantages and erases old ones. In other words, since value is determined relationally—*i.e.*, a commodity's value is dependent on its relationship (including its spatial relationship) to all other commodities—new values can only be realized by destroying old values via devaluation. This is because value is not an immutable quantity set at the point of production, as it is frequently assumed, but is always in flux. When a commodity loses its use-value through consumption, physical destruction, or economic obsolescence, for instance, its value is likewise depleted (see also Marx, 1867 [1992]; Harvey, 1982, 2017). Value is therefore largely contingent on time. And since a large portion of capital is fixed in space as buildings and infrastructure, devaluation "is always location specific" (Harvey, 1982, p. 378). The production of value in one place thus entails the production of "anti-value" in

another (Harvey, 2017). Or, to put it differently, the spatial fix in one place produces spatial obsolescence in another. Few historical examples demonstrate this dynamic more clearly than the intense bouts of urban disinvestment that underwrote postwar suburbanization.

Devaluation, it should go without saying, is painful. General economic crises are characterized by rapid and widespread devaluation in the forms of un(der)employment, un(der)utilization, drops in real wages, and falling rates of return (Harvey, 1982, pp. 195–196). In the localized crises of postwar urban disinvestment, devaluation manifested as cratering property values, land abandonment, and the physical deterioration of homes and businesses. In all cases, devaluation implies economic loss and is hence something most everyone wishes to avoid experiencing firsthand. However, Harvey (1982, p. 194) reminded us, devaluation is an inevitability because it is built into the concept of value itself. The production of value in one place and time can only occur by producing anti-value in another. Accordingly, a major aim of capital is to manage how the pains of devaluation are to be meted out. And since devaluation is always location specific, capital searches not only for places where profit can be extracted, but where losses can be stored. The most effective way to find these places, Racial Capitalism suggests, is to create them by exploiting the differential value of race (Pulido, 2017).

The RTV was, I argue, a transformative innovation in this effort. By isolating and containing the devaluation capitalism requires, the RTV—and its spatial manifestation as residential segregation—provides a double benefit to capital. The urban racial capitalism literature outlined above has already highlighted one. By racially demarcating devaluation, capital provides itself with spaces that can readily be dispossessed and

hyper-exploited to augment accumulation, which, in turn, helps stave off crises (see Bledsoe and Wright, 2019). For the last century, when capital has looked for new profitable terrain, it has continuously gone back to this well. Urban renewal, gentrification, predatory mortgage lending, and the post-Katrina rebuilding of New Orleans's Lower Ninth Ward all provide stark illustrations.

Equally crucial, though, is that by attaching anti-value to Black people specifically, the RTV also "prevents [devaluation's] impacts from bleeding over" (McClintock, 2011, p. 95) into comparatively "valued" white spaces. In that way, the devastating costs associated with both the rapid devaluation of crises and the slower devaluation of economic obsolescence—what Marx (1973, p. 751) labeled "constant devaluation"—are, by and large, spatially controlled. The RTV accomplishes this because its logic is circular. If appraisers are a priori convinced that Black presence reflects negatively on home values—or if mass appraisal technology has this assumption built into its model by proxy—they will incorporate that belief into their home appraisals, rendering it true (Freund, 2007; Howell and Korver-Glenn, 2018; see Bonds, 2019; Zaimi, 2020; Imbroscio, 2021).

The RTV thus initiates a form of *planned spatial obsolescence*—an anti-spatial fix—wherein Black residential mobility is converted into a catalyst for controlled devaluation. The effect of white-to-Black neighborhood transition is therefore to free capital tied up in that place to go elsewhere. This is, in fact, precisely what Hackworth (2016, 2019) has found in the US Rust Belt. He showed that over the past half-century, when an urban area became predominantly Black, property owners simply abandoned their property there in order to move their investments somewhere else. This accelerated

devaluation in these places and undermined the homeowner-based wealth of their predominantly Black residents. But by sacrificing these areas—by designating them for controlled devaluation—capital could cut its prospective losses and go elsewhere, opening new opportunities for investment.

Taken together, then, racialized devaluation and the spatial fix should be understood as two sides of the same coin. Devaluation is both a prerequisite for the dispossession Bledsoe and Wright (2019) identify as part of the spatial fix and a product of the spatial fix. The two perpetuate each other because the former creates the conditions for the latter, which, in turn, generates displacements that produce anti-value in a different place, starting the process anew. The uneven development immanent to capitalism, as theorized by Neil Smith (1984), is thus a fundamentally racial process. Or, as Loyd and Bonds (2018, p. 901) put it, "the uneven capitalist development of places is simultaneously a racialized process of (de)valorization and (dis)accumulation." The RTV is the mechanism that racializes—and thereby guides—this dialectical process.

The RTV was, in this way, a vital invention for racial capitalism in general. But as a product of the real estate industry, it has been especially important for real estate capital. By charting out the spaces that would contain value and anti-value—*i.e.*, by planning spatial obsolescence—the RTV imposed much-needed order and predictability onto a hitherto chaotic housing value landscape. Since real estate is fixed in space and since its value is contingent on its spatial relation to other values, the return on any single property investment substantially depends on what will happen to the surrounding area in the future. A new landfill may harm property values, whereas a new park may boost them. Or, as the RTV asserts, values may be affected by a change in the area's occupants.

Figuring out ways to accurately forecast neighborhood-level value changes was, I have highlighted, a preoccupation of the industry in the wake of the Great Depression's housing crash. Predictions could never be perfect, but enacting the RTV significantly improves the odds of one's bet. By collapsing (anti-)value with race—and then by enforcing residential segregation via restrictive covenants, redlining, racial steering, and the like—real estate capital could anticipate the value trend by regulating the racial trend. And the circumscribed movement of Black people could then be transformed into the circumscribed movement of devaluation.

Conclusion

In this chapter, I have outlined one way for scholars to reconceptualize the role of the RTV in racial capitalism. Namely, I have argued that the RTV not only pre-defined Black-occupied spaces for dispossession, but crucially, also marked them as places to contain the devaluation inherent in the process of capital accumulation. In that respect, the RTV serves a vital organizing function in (racial) capitalism by demarcating both the places where value can be hyper-extracted and where losses can be stored. Further, by attaching whiteness to value and Blackness to anti-value, the private-public real estate nexus of the twentieth century imposed a considerable degree of order onto the housing landscape. By undermining values in Black spaces to bolster them in white spaces, the RTV vastly improved how real estate capital could forecast and control neighborhood value trends. By attaching anti-value to Black people and then by controlling Black movement through discriminatory policies like redlining, blockbusting, racial steering, and the like, real estate capital could exercise an unprecedented level of control over the pace and spread of (economic) obsolescence.

Despite the RTV's centrality to racial capitalism, there is much still to be learned about its rise and development over the twentieth century. Though the urban historical-geographical literature is replete with accounts documenting the RTV's ascent as an ideology reflected in textbooks and policy, empirical work investigating its implementation and ramifications on the ground, in actual neighborhoods, remains comparatively scarce. A major exception can be found in the burgeoning scholarship surrounding the neighborhood surveying program carried out by the Home Owners' Loan Corporation (HOLC) in the late 1930s and early 1940s. As a federal agency staffed primarily by lenders and real estate professionals, HOLC produced a set of vibrant maps that graded thousands of urban neighborhoods across the US on the presumed risk their attributes—including their current and anticipated racial compositions—posed to property owners. Complete with richly detailed field notes, these mapping materials provide an unrivaled look into how real estate capital understood the RTV and put it into action. However, HOLC scholarship has generally been uninterested in them for this purpose. Rather, it has tended to fixate on how lowest-graded spaces—those marked "D" and colored red—overlay present-day inequities, likely missing the maps' and notes' broader significance for understanding the RTV. The remainder of this dissertation is therefore dedicated to revisiting this mapping program, trudging through the debates surrounding it, and recouping its potential to inform us about the RTV in action.

CHAPTER 3

FEDERAL "REDLINING" MAPS: A CRITICAL REAPPRAISAL[5]

[5] Markley, Scott. Submitted to *Urban Studies*, May 26, 2022.

Abstract

In the past decade, the Home Owners' Loan Corporation's (HOLC) so-called "redlining" maps have gone from a niche corner of urban historical scholarship to the center of mainstream narratives about racism in the United States. In this chapter, I map this journey and trace the contours of the ongoing debates that have emerged, identifying two competing camps I call "HOLC Culpable" and "HOLC Skeptical." Finding these perspectives to have run up against their self-imposed limitations, I outline a research agenda that breaks from the debate's narrow confines by reading the HOLC mapping program through the lenses of racial capitalism and critical cartography. This approach recasts the maps and their accompanying field notes as a window into the governing racial-spatial ideology of twentieth-century US real estate capital. In doing so, it invites researchers to reimagine the map grades as dynamic categories reflecting a particular spatiotemporal conception of value that is highly contingent on an area's estimated racial trajectory. This reformulation, I argue, not only opens new possibilities for studying the HOLC mapping program but suggests that the power of these maps has almost certainly been underestimated.

Introduction

"Redlining" maps produced in the late 1930s by a New Deal-era federal agency called the Home Owners' Loan Corporation (HOLC) have recently entered mainstream discussions about racism in the United States. They featured prominently in widely circulated, award-winning publications like Ta-Nehisi Coates' (2014) *The Case for Reparations*, Richard Rothstein's (2017) *The Color of Law*, Mehrsa Baradaran's (2017) *The Color of Money*, and Nikole Hannah-Jones's *The 1619 Project* (see Lee, 2019). They

are also the subject of the University of Richmond's highly acclaimed *Mapping Inequality* project (Nelson *et al.*, 2022), and studies connecting the map grades to a multitude of ongoing social inequities continue to grab headlines in top media outlets (*e.g.*, Badger, 2017; Jan, 2018; Thebault, 2018; Anderson, 2020; Godoy, 2020; Popovich and Palmer, 2020; Capps and Cannon, 2021; Best and Mejia, 2022; Zhong and Popovich, 2022). Proposals to address the lingering effects of HOLC redlining even appeared in the campaign platforms of three Democratic candidates in the 2020 US presidential primary, while a related bill introduced by US Senator Elizabeth Warren waits for a vote in Congress (Capps and Mock, 2019). Beneath the surface, however, intense debates about the maps' actual impact on contemporary racial housing geographies have been bubbling.

Two broad factions have coalesced. The first—which I call "HOLC Culpable"—holds that HOLC's "Residential Security" maps played a significant role in shaping future geographies of racial housing segregation and related inequities. This is the dominant camp, and its view has been amplified—and distorted—in prominent discussions of the HOLC maps, including those listed above. The second—which I call "HOLC Skeptical"—disputes this story on several counts. Its adherents maintain that the maps, created as part of HOLC's "City Survey" program, were not actually used for redlining and are thus likely to be unhelpful if not downright misleading. Although the Skeptical position remains in the minority, it is rapidly gaining favor in academic circles and has successfully pressured many with Culpable sympathies to temper or abandon some of the camp's original claims.

Currently, the space between and including these opposing positions is where virtually all of the scholarship about HOLC's mapping program has taken place.

Perspectives have primarily come from (1) those active in the debates, (2) those who accept and spread the Culpable position unchallenged—or even exaggerate it—as part of a larger narrative about the legacies of racism in the US, and (3) those within the Culpable camp who seek to statistically evaluate how HOLC neighborhood grades map onto a wide array of present-day social inequities. Though leading to some constructive insights, this body of work has relied on a rigid set of assumptions about the HOLC maps that have constrained its practitioners' methodological imaginations. In general, they have unduly prioritized "redlined" areas over other neighborhood designations, emphasized the maps over their accompanying field notes, treated the map grades as static rankings that range from "best" to "worst," and overlooked the considerable internal variability within the map grades. As I argue, these self-imposed limitations of the HOLC literature have regrettably curtailed the types of questions researchers have asked, leaving a number of potentially more illuminating avenues unexplored.

This chapter has two main objectives. The first is to trace the ongoing development of the HOLC Culpable and Skeptical perspectives, highlighting their origins, claims, and current statuses. In doing so, I argue that the narrow confines of the HOLC redlining debates have enshrined a series of simplistic and ultimately limiting assumptions about the HOLC mapping program that have stymied critical inquiry. The second objective is to chart a path out of this morass. To accomplish this, I propose a research agenda that reads the HOLC mapping program through the lenses of racial capitalism (Robinson, 2000 [1983]) and critical cartography (see Crampton and Krygier, 2006). Rather than simply evaluating the use, spread, and impact of the physical maps themselves, these frameworks invite researchers to approach the maps and their field

notes together as an indispensable window into the governing racial-spatial ideology of twentieth-century real estate capital in the US. In doing so, they recast HOLC map grades as dynamic, relational categories that reflect a spatiotemporal conception of value that is deeply tied to race. Such an approach gives new life to the City Survey program as an object for critical research and suggests that the power of the maps has been vastly underestimated.

This chapter proceeds in four parts. In the next section, I trace the history of "redlining" as a concept and how it became so widely associated with HOLC. This leads me directly into a discussion of the origins of the HOLC Culpable position, which emerged with the groundbreaking work of historian Kenneth Jackson in the early 1980s. In the section following, I present the HOLC Skeptical position. This camp was established by urban scholar Amy Hillier in the early 2000s as a direct response to Jackson. Then, I discuss the current statuses of the debates, introducing a minority branch within the Culpable camp that has internalized many of the critiques made by Skeptics. I conclude by proposing some new directions to take HOLC scholarship.

Redlining and HOLC Culpablism

The term "redlining" was popularized by Chicago-based housing activists in the late 1960s and 1970s (Pogge, 1992; Marchiel, 2020). It was adopted to describe the institutional practice of refusing to issue fairly priced home mortgages or insurance in areas deemed too risky for investment due to their racial composition, income level, housing age or condition, or some combination thereof (see Squires, 1992a). Lenders and insurers, it was said, marked these places off their maps using red ink. Since these institutions typically equated Black residential presence with risk, Black urban

neighborhoods were disproportionately affected. They were cut off from affordable credit and suffered intense bouts of disinvestment as a result. This undermined intergenerational Black wealth accumulation, and set the stage for later rounds of predatory extraction (Dymski, 2009; Taylor, 2019). Thanks largely to activist pressure, redlining was effectively outlawed through a suite of federal legislation in the 1970s, most notably the Community Reinvestment Act (CRA) of 1977.

Scholarly interest in redlining emerged alongside efforts to ban the practice. This early work came primarily from scholar-activists who called for the enforcement of more equitable lending standards, eventually codified with the CRA (Squires, 1992a). Importantly, these interventions discussed redlining nearly exclusively as a practice of private industry, though many noted the complicity of the Federal Housing Administration (FHA) (Goldberg and Elenowitz, 1973; Bradford, 1979; Rubinowitz and Trosman, 1979; see also Squires, 1992b). After the passage of the CRA, private-sector redlining remained an important reference for researchers studying the persistence of racial lending discrimination (Dedman, 1988; Squires, 1992b; Wyly and Holloway, 1999; Holloway and Wyly, 2001; Aalbers, 2011) and, eventually, subprime mortgage lending—sometimes referred to as "reverse redlining" or "greenlining" (e.g., Newman and Wyly, 2004; Crump *et al.*, 2008; Hernandez, 2009). However, by the 2010s, redlining was much more commonly described as a government program associated with HOLC.

The first to link redlining to HOLC was historian Kenneth Jackson (1980), who (re)discovered their Residential Security maps in the late 1970s. HOLC, it was already known, was a federal agency established in 1933 as part of Franklin Roosevelt's New Deal. Its initial purpose was to rescue savings and loan institutions (S&Ls) and help

struggling homeowners avert foreclosure by refinancing their mortgages on terms that reduced monthly payments (Harriss, 1951). After the refinancing program ended after just three years, Jackson (1980) revealed, HOLC carried out a massive data gathering and appraisal project as part of its "City Survey" program, mapping thousands of neighborhoods across over 200 cities in the late 1930s. The maps, now well-known, rank neighborhoods by the purported risk they posed to property investors on an A-to-D scale. "A" neighborhoods are labeled "Best" and colored green. "B" neighborhoods are labeled "Still Good" and colored blue. "C" neighborhoods are labeled "Definitely Declining" and colored yellow. And "D" neighborhoods are labeled "Hazardous" and colored red.

Reading through the maps' accompanying "Area Description" sheets and related documents, Jackson (1980) made five claims that established the bedrock of HOLC Culpablism. The first was his postulation that HOLC *may have* initiated the practice of redlining. Specifically, Jackson contrasted Harriss's (1951) positive assessment of the agency by musing that a "less favorable judgement would be that the Home Owners' Loan Corporation initiated the practice of 'red lining'" (Jackson, 1980, p. 423). Second, Jackson noted that following the advice of the day's top real-estate economists and appraisal experts, "black neighborhoods were invariably rated as Fourth [D] grade" (p. 423). Third, although Jackson did not believe HOLC expressly advocated redlining nor practiced it themselves, he claimed that their maps and appraisal methods influenced private lenders to avoid D-graded areas. Fourth, Jackson (p. 430) assumed that HOLC's "appraisal methods, and perhaps the maps themselves, were adopted by the FHA," which, in turn, underwrote postwar suburbanization and center-city disinvestment through its patently discriminatory mortgage insurance program. And finally, Jackson (p. 447)

framed HOLC's mapping program via its assumed influence on private lenders and the FHA as a "self-fulfilling prophec[y]" that actively helped produce the uneven geographies of race and value it predicted.

It is unclear how far Jackson's account would have traveled on its own momentum. In the first five years following publication, the article had only been cited four times. However, in 1985, Jackson republished it as a chapter in *Crabgrass Frontier*, which would become a fixture in urban planning, history, and geography courses for decades to come. From there, Jackson's version of the HOLC redlining story was set. In the 1990s and 2000s, it spread rapidly. Scores of new landmark books on racial segregation and inequality accepted and circulated Jackson's Culpable position virtually unchallenged (e.g., Cohen, 1990, 2003; Massey and Denton, 1993; Oliver and Shapiro, 1995; Sugrue, 1996; Nicolaides, 2002; Self, 2003; Dreier, Mollenkopf and Swanstrom, 2004; Kruse, 2005; Roediger, 2005; Lipsitz, 2006).

As Jackson's account gained prominence, many of his qualified speculations were transformed into confident declarations. Perhaps the most pervasive tendency was to claim that HOLC itself—and by implication, the federal government—initiated redlining. This slippage appeared early on in the work of Cohen (1990, p. 276) and Massey and Denton (1993, p. 51), and it continued to multiply from there. In his highly acclaimed essay, *The Case for Reparations*, Coates (2014) even made a special point to emphasize that "[i]t was the Home Owners' Loan Corporation, not a private trade association, that pioneered the practice of redlining." And similar suggestions are present in Rothstein's (2017) *The Color of Law*, the cover of which is adorned with a Residential Security map

and the provocative subtitle, “A Forgotten History of How Our Government Segregated America.”

Other slippages and exaggerations have also been common around the idea that the HOLC maps served as a self-fulfilling prophecy. This argument, which comes straight from Jackson, assumes the maps were used to guide institutional decisions about where to buy, sell, lease, lend, insure, and/or convert property. However, Jackson’s only evidence that private lending institutions used the maps were archival documents suggesting that lenders in Newark, New Jersey referenced the HOLC grades by name (e.g., “D-3”). And he can only speculate that the FHA “probably” referenced the maps (Jackson, 1985, p. 203). Regardless, scholars have regularly glossed over the uncertainty and contingency of these statements, claiming that the FHA directly referenced HOLC maps to design its lending insurance program (e.g., Nicolaides, 2002; Kruse, 2005; Coates, 2014; Baradaran, 2017; Gibbons, 2018; Glotzer, 2020) or that lending institutions across the country—and not just a handful of agents in one city—had regular access to the maps (e.g., Cohen, 1990, 2003; Sugrue, 1996; Nicolaides, 2002; Dreier, Mollenkopf and Swanstrom, 2004; Baradaran, 2017). Further distorting Jackson’s account, many have also asserted that HOLC used its own maps for redlining (Krysan and Crowder, 2017; Rothstein, 2017; Lee, 2019; Glotzer, 2020; Bailey, Feldman and Bassett, 2021), and some have even proclaimed that the agency practiced redlining into the 1970s (Lipsitz, 2006; Perry, 2020). Notably, as Jackson (1980) himself explained, HOLC ceased its lending operations in 1936, before the maps were drawn.

In recent years, an explosion in quantitative HOLC Culpable scholarship has moved the conversation another degree away from the source material. Enabled by the

2016 release of georeferenced HOLC neighborhood polygons by the University of Richmond's Digital Scholarship Lab (Nelson et al., 2022), this rapidly growing body of work starts from the assumption that the maps were used in some discriminatory way by some institution at some point in time. Detailing how—or if—the maps were used is less of a concern to its contributors than finding statistical correlations between the map grades and a multitude of present-day social inequities. And the list of inequities has been expanding at an astounding rate. Studies have linked HOLC map grades to contemporary racial, income, and home value segregation (Appel and Nickerson, 2016; Krimmel, 2017; Rutan and Glass, 2018; Faber, 2020; Aaronson *et al.*, 2021; Aaronson, Hartley and Mazumder, 2021), as well as tree canopy coverage (Locke *et al.*, 2021), heat exposure (Hoffman, Shandas and Pendleton, 2020; Wilson, 2020; Schinasi *et al.*, 2022), pollution and other environmental hazards (Grove *et al.*, 2018; Moxley and Fischer, 2020; Fortner *et al.*, 2021; Lane *et al.*, 2022), myriad health outcomes (see Lee *et al.*, 2022; and Swope, Hernández and Cushing, 2022 for reviews), police violence (Bloch and Phillips, 2022; Mitchell and Chihaya, 2022), "food environments" (Li and Yuan, 2022), broadband access (Skinner, Levy and Burtch, 2021), apartment locations (An, Orlando and Rodnyansky, 2019), tobacco retailers (Schwartz *et al.*, 2021), oil and gas wells (Gonzalez *et al.*, 2022), and innumerable others.

Making for good headlines, these studies have gained an impressive amount of media attention. They have been covered in *The New York Times* (Badger, 2017; Popovich and Palmer, 2020; Popovich and Zhong, 2022), *The Washington Post* (Jan, 2018), *Bloomberg* (Capps and Cannon, 2021), *NPR* (Anderson, 2020; Godoy, 2020), *The Atlantic* (Thebault, 2018), and many more. Along with the broader historical HOLC

Culpable literature, this work has also provided empirical support for Elizabeth Warren's proposed American Housing and Economic Mobility Act, which aims to offer modest down-payment subsidies to qualified homebuyers living in former C- and D-graded neighborhoods (Warren, 2021). Faced with the overwhelming ubiquity of HOLC Culpablism and its many perversions, it is easy to forget that each of its five pillars came under serious scrutiny in the early 2000s.

HOLC Skepticism and the Smoking Gun Theory

Urban scholar Amy Hillier mounted a sweeping challenge to the HOLC Culpable position across a series of articles that came out of her dissertation (Hillier, 2002, 2003a, 2003b, 2005a, 2005b). Evident in this work is a frustration that Jackson's account had been elevated to unrivaled orthodoxy even though much of it had never been substantiated. Although HOLC's Area Description sheets revealed shocking levels of racial prejudice in their appraisal process, Hillier agreed, no one had shown that the maps had actually been used for redlining. And few seemed interested in the question. Hillier took this task up herself, presenting counterclaims that would shake all five pillars of the HOLC Culpable edifice. This work built the foundation for an opposing camp I call "HOLC Skepticism," and it launched the HOLC redlining debates.

Hillier's first order of business was to dispel the idea that HOLC could have initiated redlining as a practice. She disputed this possibility in three key ways. First, she located archival documents from before HOLC existed that described and advocated practices analogous to redlining among private lenders (Hillier, 2003a). Second, citing HOLC's Area Description sheets, she pointed out that the agency's own field agents regularly noted that lenders were already systematically avoiding many lower graded

areas (*ibid.*; see also Chapter Four). Finally, conducting statistical analyses in Philadelphia, she found that HOLC did not itself practice redlining (Hillier, 2003b). On the contrary, the local office frequently issued refinancing loans to Black and immigrant applicants. Moreover, although the maps were produced after HOLC's refinancing program had ended, she found that the Philadelphia office issued over 60 percent of its loans in places that would eventually be assigned a "D" grade (ibid.). Similar patterns have recently been found in three other cities (Fishback *et al.*, 2021).

Jackson's second claim—that Black spaces were "invariably" assigned D grades—was also thrown into question by Hillier's work. To test this argument, Hillier (2005a) compared three iterations of Philadelphia's HOLC maps to a series of demographic, socioeconomic, and housing variables from the Census and a local housing survey. Though she found the Black population percentage to be strongly correlated with map grades as Jackson would have expected, she also found that that relationship weakened across map versions over time and that several housing variables had stronger associations than racial composition. This latter finding has been replicated in other northern cities (Greer, 2012; Fishback *et al.*, 2020), with Fishback and colleagues (2020) even suggesting that there is little evidence of any racial bias in the HOLC appraisal process. Rather, they argue, the disproportionate share of Black residents in D neighborhoods in the nine northern cities they investigated can better be explained by other variables correlated with Black presence, like home values, rents, occupancy, and ownership.

The third, fourth, and fifth pillars of the HOLC Culpable position should be considered mutually reinforcing. Together they hold that the HOLC appraisal methods—

if not the maps themselves—were used by private lenders and/or the FHA to produce the conditions the maps predicted. These claims are, in many ways, the most consequential. They are what make the HOLC maps significant in Jackson's original telling and what many in the Culpable camp reference most vigorously. They also undergird the most recent wave of statistical Culpable scholarship. Hillier, therefore, dedicated the bulk of her work to challenging these arguments.

Hillier first took aim at Jackson's (1985, p. 203) remark that "[o]bviously, private banking institutions were privy to and influenced by the government's Residential Security Maps." Revisiting the archives, she found that to the contrary, HOLC and its parent agency, the Federal Home Loan Bank Board (FHLBB), were highly protective of the maps (Hillier, 2003a, 2005a). In fact, she discovered, only a few dozen maps were made of each city and most never left FHLBB offices. She did find that some were shared with other government agencies, including the FHA, but little evidence suggested they were ever distributed to private firms. And although HOLC hired local lenders as field agents to help create the maps, she noted that they represented only a tiny fraction of each city's total number of lending institutions. Thus, she reasoned, they could not have had a significant influence on citywide lending patterns.

Regarding Jackson's evidence that some Newark mortgage lenders mentioned HOLC neighborhoods by name, Hillier (2003a) revealed that the comments he cited came from interviews in which FHLBB employees, not private lenders, wrote up the responses. Accordingly, they do not provide strong evidence that lenders were familiar with the maps, especially considering that the maps went virtually unmentioned in any trade publication or book until Jackson's work. To further bolster these findings, Hillier

(2003a, 2005b) analyzed address-level mortgage data in Philadelphia in the years following the City Survey program. She found that although mortgage interest rates were higher, on average, in C and D areas, lenders in the aggregate were no less likely to issue loans there. Furthermore, while some types of lenders issued only a small volume of home loans to those places, none avoided them entirely. Crossney and Bartelt (2005a, 2005b) found concurring evidence in Pittsburgh. However, it is worth pointing out that Hillier's definition of redlining here is quite narrow. Her finding that lenders charged higher interest rates and/or mostly avoided low-graded neighborhoods still constitutes redlining by some definitions (*e.g.*, Squires, 1992a).

If few private lenders were likely to see or even know about the HOLC maps, then what about the FHA? Hillier (2003a, 2005a) did acknowledge that HOLC shared some maps with FHA officials. However, she contended that the purpose was likely to compare notes on neighborhood valuation techniques rather than to guide the FHA's mortgage guarantee program. Indeed, this program preceded the City Survey program, and the FHA had its own set of maps and appraisal standards (Hillier, 2003a; Greer, 2014; Fishback *et al.*, 2021). Although the maps on file at the FHA offices have been destroyed (Michney, 2022), a handful of copies have been recovered from local government offices. Analyses of these maps in Chicago have shown that while there was considerable overlap, there were also numerous key discrepancies (Greer, 2014; Xu, 2021). And studies by Xu (2021) and Fishback and colleagues (2021) found that the FHA grades, where available, had a markedly more significant impact on future geographies of residential segregation, housing price, and loan availability than the HOLC ones.

Given this well documented evidence against the HOLC Culpable position, why does it remain so dominant? Hillier offered a theory. The maps, in all their enrapturing detail, tell a simple and compelling story that placed a "smoking gun" (2003a, p. 413) in the federal government's hand on the eve of the US's most transformative spatial reorganization of the last century: the postwar overinvestment in white-majority suburbs and concomitant underinvestment in Black-majority urban cores. Combined with the unambiguously racist language in their Area Description sheets, HOLC became a convenient culprit. At best, according to Skeptics, the Culpable narrative mixes up some basic facts. At worst, it absolves the private sector for its integral role in producing and maintaining racial housing segregation. Despite the expanding dominance of Culpable arguments in mainstream accounts, Hillier's HOLC Skeptical position has left its mark in numerous discreet ways. And as attention to the HOLC maps has grown in recent years, more scholars have begun to grapple with its implications.

The HOLC Redlining Debates

Hillier's body of work had some noticeable effects on how HOLC was discussed in the broader literature. In the years separating her work from the most recent wave of HOLC scholarship, this was most evident in three subtle but telling adjustments. First, scholars mentioning Jackson's assessment of the City Survey program were now obliged to also mention Hillier's (Freund, 2007; Gordon, 2008; Lands, 2009; Aalbers, 2011, 2014; McClintock, 2011; Howell, 2015). No longer were Jackson's claims definitive. They represented but one perspective. Second, the argument that HOLC initiated redlining was pushed to the fringe of the conversation. Authors increasingly underscored

that HOLC did not initiate redlining but accomplished something more difficult to define and disprove, like "institutionalize" it (see Aalbers, 2011, p. 85).

Third, and most notably, the language around HOLC's influence on the housing landscape was tempered considerably. This is perhaps most evident in David Freund's (2007) *Colored Property*, which was the first significant post-Hillier addition to the HOLC canon. Though Freund (2007, p. 431) dismissed much of Hillier's argument in the endnotes, he avoided claiming that the HOLC maps were used by private lenders and the FHA. Rather, he argued that HOLC's significance was that it (1) provided an economic rationale for residential segregation "with the blessing and financial support of the federal government" (p. 116) and (2) "introduced" an appraisal logic "to the national mortgage market" that defined non-white "homeownership as an actuarial risk to white people" (p. 118). Freund did not explain how HOLC achieved this, but the argument signifies a substantial revision of the Culpable position. In this view, the significance of the maps was not in their functional use but their influence on how institutional actors perceived the relationship between race and value in residential space.

HOLC Skepticism also received direct pushback. Louis Woods (2012) buttressed Freund's argument by showing through his archival work that there was much more cross-pollination between HOLC, the FHA, and S&Ls than Skeptics led on, albeit it was not as direct as Jackson had implied. Woods found that in 1937, a Joint Committee on Appraisal and Mortgage Analysis was convened so that the FHLBB, FHA, American Institute of Real Estate Appraisers, and three other organizations could "coordinate the efforts of both government and non-government agencies interested in valuation and mortgage financing" (Woods, 2012, p. 1038). Additionally, he noted that the FHLBB

distributed a monthly publication to its thousands of member S&Ls that frequently included advice on how to assess properties using standards consistent with the HOLC maps and field notes. In one instance, he discovered, the FHLBB provided its members with instructions on how to effectively recreate the Residential Security maps, even defining four categories of lending areas that were identical to HOLC's.

Todd Michney and LaDale Winling have further advanced Freund's and Woods' softened brand of HOLC Culpablism in recent years. They have highlighted that while much has been made of HOLC's surprisingly equitable lending practices before the City Survey program, it "appears far less counterintuitive" when considering that the agency's refinancing program maintained residential segregation and benefitted the white creditors who held a disproportionate share of Black mortgages (Michney and Winling, 2020, p. 172). Building from Freund and Woods, they have also vehemently contested the Skeptical suggestion that HOLC appraisals were less racially discriminatory than commonly assumed. Tracing the knotty entanglements between HOLC, the FHA, lenders, appraisers, and academics, they argued that HOLC represented but one node in a much larger web of powerful institutions and individuals who entrenched a real estate appraisal system that cast Black residential presence as a threat to home values (see also Weiss, 1989; Zaimi, 2020; Winling and Michney, 2021; Michney, 2022).

Michney and Winling have also attacked this idea more directly. They pointed out that while not all of HOLC's D-graded neighborhoods were majority Black, all but six Black-majority neighborhoods in the county were assigned a D grade (Winling and Michney, 2021; Michney, 2022). This explains why Hillier's (2005a) and Greer's (2012) linear regressions found that other variables correlated more strongly with HOLC grades

than racial composition. It was not because Black presence carried less weight in HOLC's appraisal process but because Hillier's and Greer's models were not designed to capture the fact that Black presence was a *sufficient but not necessary* factor in determining neighborhood grades nearly everywhere. Relatedly, as Michney (2022) implied, Fishback and colleagues' (2020) treatment of housing values as independent of Black presence missed how race and value were co-constituted (Freund, 2007; Bonds, 2019; Taylor, 2019; Markley *et al.*, 2020; Zaimi, 2020, 2022). There is thus not a dependable way to examine how they impacted HOLC grade determinations apart from one another.

Fishback and colleagues (2020) did not suggest that housing discrimination was unimportant, however. They argued against the idea that the HOLC maps played an active role in shaping the future housing landscape, pointing out that pre-HOLC housing and wage discrimination had already confined Black households in northern cities to areas with worse housing conditions before the maps were drawn. Therefore, they contended, growing rates of residential segregation in the 1930s picked up the trend from previous decades; they were not accelerated by HOLC. Notably, their primary target in this and later work (Fishback et al., 2021) was the booming quantitative Culpable scholarship aiming to explain nearly any contemporary urban socio-spatial inequity imaginable with HOLC map grades. Hence, they were not responding to the more nuanced, revised arguments positioning the City Survey program among a broader array of forces but to the more vulgar (and dominant) wing of the Culpable camp. As Fishback and his coauthors (2021, p. 11) recognized, there is a distinction worth making "between the dissemination of mapmaking techniques versus the dissemination of the HOLC's

maps themselves," and the frequent collapsing of the two has undoubtedly muddled the conversation.

Acknowledging this consistent source of miscommunication leads us to a critical juncture in the debates. A main concern of Skeptics is that the overemphasis on HOLC maps confuses rather than clarifies how racial inequities have been reproduced through time. Certainly, this is hard to deny. But a tempting implication here is that scholars may well be better off ignoring the HOLC maps altogether. After all, there is little evidence that they were actively used by lenders, and there is mounting evidence that the FHA map grades were more consequential (Fishback et al., 2021; Xu, 2021). However, that still leaves an important question: how have so many studies found a significant relationship between HOLC neighborhood boundaries and future geographies of home values, housing loss, residential segregation, and the like (Appel and Nickerson, 2016; Krimmel, 2017; An, Orlando and Rodnyansky, 2019; Aaronson, Hartley and Mazumder, 2021)? The thread connecting these inequities and the HOLC grades may be looser than that connecting them to FHA grades. But in the absence of the latter, these findings have indirectly demonstrated that the HOLC maps can tell us something about how institutional constructions of value helped reproduce social inequities in space through time, regardless of the actual use—or not—of the HOLC maps. This, of course, has not been how authors of these studies have framed it. They have, as Skeptics have claimed, generally misunderstood the mechanism of the maps. But this alternative interpretation of their results is consistent with the subtler and more coherent arguments of Freund, Woods, and Michney and Winling. And it points to new ways scholars can engage with the HOLC mapping program.

New Directions

The HOLC redlining debates have produced much-needed clarifications about the City Survey program. One, HOLC did not initiate redlining. Two, HOLC did not itself redline when carrying out its refinancing program, which predated the maps. Three, Black residential presence was a sufficient but not necessary factor in assigning neighborhoods a D (red) grade. Four, private lenders did not have ready access to the HOLC maps, and the FHA did not use the HOLC maps to carry out its mortgage guarantee program. The FHA produced their own maps, and private lenders likely did too, though their criteria was probably similar to HOLC's. However, HOLC did share its maps with the FHA, and as Michney (2022, p. 318) argued, "HOLC utilized numerous other channels to disseminate its damaging, racialized thinking about property values." Last, while the physical creation of the HOLC maps probably did not directly entrench racial segregation—though Faber (2020) claims that they might have—it suggests a mode of thinking about race and value that informed the era's lending, appraisal, and real-estate industries. In this way, the power of the maps has not only been broadly misunderstood but has almost certainly been underestimated.

To appreciate how the HOLC mapping program has been underestimated, we need an alternative approach to studying the maps and their accompanying Area Description sheets. Clearly, the vulgar treatment of the City Survey program by the dominant branch of the Culpable camp should no longer be accepted. These accounts are riddled with factual errors and spurious assumptions, and there are diminishing returns on the value of yet another study linking HOLC "redlining" to another social injustice. Yet, HOLC Skepticism was only ever developed to counter the excesses of Culpablism. It thus offers no vision forward. The more nuanced arguments elaborated by Freund, Woods,

and Michney and Winling present an important synthesis, but they have not escaped the narrow confines established by the debates. Accordingly, they have not offered a research agenda that meaningfully departs from the existing body of Culpable scholarship. They do offer a solid foundation upon which to build, however, so long as successive work can break from the constricted arena that has contained HOLC research thus far. To initiate this break, I propose bringing this latter body of work together with two existing frameworks that offer some promising new directions to take HOLC scholarship: racial capitalism and critical cartography.

Developed by Cedric Robinson (1983[2000]), Racial Capitalism as theory recognizes racism as a constituent feature of capitalism. Processes fundamental to capitalism—accumulation and dispossession, finance capital circulation, and uneven development, for example—are thus understood to be always-already shaped by white supremacy (see also Melamed, 2015). There is already a robust literature that expressly or implicitly applies this hermeneutic to better understand how urban space has been constructed to underpin white wealth and autonomy by undermining Black wealth, autonomy, and claims to space (e.g., Wilson, 2000; McKittrick, 2006; Lipsitz, 2011; McClintock, 2011; Marable, 2015; Pulido, 2016, 2017; Woods, 2017; Bledsoe and Wright, 2019; Bonds, 2019; Taylor, 2019; Bledsoe, 2020; Markley *et al.*, 2020; Zaimi, 2020, 2022; Fields and Raymond, 2021; Jenkins, 2021; Purifoy and Seamster, 2021; Seamster and Purifoy, 2021). Extending this work to reevaluate the City Survey program, researchers can approach the HOLC maps and their field notes as a critical window into the governing racial-spatial ideology of real estate capital on the eve of the US's most dramatic expansion of homeownership to date. Such a reading is regrettably foreclosed

by the current literature's fixation on measuring the effects of map grades, but it would significantly expand what insights can be gained from the HOLC maps and notes. Among other things, a racial capitalism framework can further illuminate how the era's private-public real estate nexus discursively collapsed race and value in urban space (and time). And it can help researchers explore how this collapsing has shaped residential space beyond the limited boundaries of the HOLC maps.

Critical cartography offers another constructive approach. In general, this theoretical framework "challenges academic cartography by linking geographic knowledge with power" (Crampton and Krygier, 2006, p. 11; see also Harley, 1989). This, of course, entails many competing approaches (Dodge, Kitchin and Perkins, 2009), but Aalbers (2014) provides a useful example of what one critical cartographic reading of the HOLC mapping program might look like in practice. He argued that the HOLC maps served a performative function by helping to produce a particular geography that served powerful interests. Though light on the contextual details, Aalbers opens some new avenues for inquiry here that are later exemplified by Nelson (2021). A critical cartographic approach, broadly construed, allows us to reimagine the HOLC map grades altogether. Rather than regarding them as static representations of space, we can see them instead as dynamic categories drawn by powerful institutional actors aiming to impose some order and predictability onto a chaotic value landscape for the benefit of real estate capital (see also Winling and Michney, 2021; Michney, 2022). This insight again invites us to look beyond the physical borders of the HOLC maps, focusing instead on how the spatiotemporal constructions of value reflected in the maps and notes helped produce a

housing landscape for real estate capital and at the expense of the residents its agents devalued.

Reading the City Survey program through the frameworks of racial capitalism and critical cartography introduces a set of research possibilities that have so far been shut off by the HOLC redlining debates. To fully realize the potential here, there is also a need to break from the limiting—and frankly, unimaginative—set of epistemological and methodological habits that continue to constrain HOLC scholarship. I conclude this paper by highlighting three escape routes. First, as I have suggested, it is no longer sufficient to examine the map grades apart from their notes. Rather than prioritizing the maps over the field notes, researchers must treat them as a unified data product, wherein the latter provides the data, rationale, and context for the former. This calls for more in-depth, qualitative inquiries into the Area Description sheets, and it implies a need to examine the considerable variability within the map grades. Fortunately, many of the Description sheet variables have recently been cleaned, tabulated, and made publicly available to researchers (Markley, 2023), and there are some exemplary deep dives into the field notes that can serve as useful guides (e.g., Howell, 2015; Nelson, 2021).

Second, the extant literature unjustifiably prioritizes the D grades over the other neighborhood designations. However, recognizing the map grades as spatiotemporal categories means that one grade cannot be understood apart from the others. Rather than regarding the grades as stand-alone rankings from best to worst, then, researchers should approach them as relational configurations that charted and inscribed expected value trajectories in space. In this view, “yellow-lined” areas were not perceived to be “better” than “redlined” areas but to be further along on their schedules toward becoming like

"redlined" areas than green or blue neighborhoods. And crucially, with this spatiotemporal conception of value, the residential presence of Black and certain immigrant populations was perceived to be an accelerant of this inevitable progression toward obsolescence (see Winling and Michney, 2021). In this way, the map grades denote a specific notion of time as much as they do space. Such a reconceptualization calls for spatial analyses that go beyond simplistic overlays of D boundaries onto present-day phenomena. It requires shifting attention to the other map grades and to the relations that link and define them. Moreover, it suggests that the "no-lined" (Howell, 2015, p. 148) areas of the maps—such as the designated commercial, industrial, and rural districts—contain important clues about how the lending, appraisal, and real estate industries of the day understood and produced space.

Finally, despite the widespread misconception, it has been well established that most D-graded neighborhoods did not contain any Black residents. This is not surprising given that the largest wave of Black migrants to northern cities did not occur until after World War II. However, treating the map grades as dynamic categories reflecting a hegemonic racial-spatial-temporal conception of value means dramatically changing how scholars study the legacies of HOLC "redlining." For one, it suggests that many of the linkages found between HOLC "redlining" and contemporary social inequities may simply be masking stronger relationships between those inequities and racial segregation. It is therefore imperative for researchers to disentangle the HOLC map grades from race in their analyses, lest they further contribute to the mistaken perception that housing discrimination occurred primarily *in* D-graded neighborhoods rather than *to* Black people. This misconception has already fueled charges that redlining did not undermine

Black wealth (e.g., McWhorter, 2021), and it will likely continue to be marshaled against reparative justice efforts if left uncorrected. Thus, the goal for critical researchers cannot be to preserve the lingering myths of HOLC Culpablism. It must be to hasten their eradication by envisioning the HOLC mapping program anew.

SECTION II

Data Preparation

CHAPTER 4

TABULATING HOME OWNERS' LOAN CORPORATION AREA DESCRIPTION SHEET DATA[6]

[6] Markley, S. (2023) 'Tabulating Home Owners' Loan Corporation area description sheet data', *Environment and Planning B: Urban Analytics and City Science*, 50(1), pp. 268–280. Available at: https://doi.org/10.1177/23998083221133112. Reprinted here with permission of publisher.

Abstract

In the late 1930s, an agency of the United States government called the "Home Owners' Loan Corporation" (HOLC) graded thousands of urban neighborhoods on the perceived risk they posed to property owners. To make these determinations, HOLC field agents collected vast amounts of socioeconomic, demographic, and housing data about these places and presented their findings in an impressive set of maps. While these "redlining" maps have received considerable academic and media attention, the neighborhood-level race, housing, and socioeconomic data used to assign risk grades—available for most cities in their "area description" sheets—remain virtually unusable. Correcting this issue, I convert eight of the most consequential variables from 129 cities into an accessible and analyzable tabular format. These include the Black population percentage, "foreign-born" population percentage and group, family income, occupation class, average building age, home repair status, and mortgage availability. This data product will allow researchers to gain a more complete picture of the HOLC's City Survey program, and it will provide a valuable new source of historical socio-demographic data at the neighborhood level.

Background and Summary

The Home Owners' Loan Corporation (HOLC) was a US federal agency that created a series of "residential security" maps in the late 1930s as part of their City Survey program. To make these maps, teams of appraisers surveyed thousands of neighborhoods across hundreds of cities, grading them on the projected risk they posed to property owners and investors (Jackson, 1980, 1985; Hillier, 2003a, 2005a; Michney, 2022). The agency relied on a now-infamous A-to-D grading schema that ranged from "Best" (green) to "Hazardous" (red) and was heavily influenced by an area's racial,

ethnic, nationality, and class compositions, as well as the age and condition of its housing stock (Jackson, 1980; Hillier, 2003a; Freund, 2007; Light, 2010; Greer, 2012; Woods, 2012; Michney, 2022) (see **Figure 4.1**). These "redlining" maps were also accompanied by "area description" sheets (ADS) that contained a rich collection of qualitative and quantitative information about the places that were mapped. For most HOLC neighborhoods, these sheets include detailed descriptions of their demographic, socioeconomic, housing, locational, and even physical characteristics (see **Figure 4.2**).

In recent years, the HOLC maps have gained significant attention among scholars and the broader public. They featured prominently in award-winning publications like Ta-Nehisi Coates's (2014) *The Case for Reparations* and Richard Rothstein's (2017) *The Color of Law*, and they were referenced in the policy platforms of three candidates in the 2020 Democratic primary (Capps and Mock, 2019). They are also the subject of ongoing debates about the US government's role in (re)producing racial housing segregation and inequality during the 20th century (Faber, 2020; Fishback *et al.*, 2020, 2021; Michney and Winling, 2020; Aaronson *et al.*, 2021; Aaronson, Hartley and Mazumder, 2021; Nelson, 2021; Winling and Michney, 2021; Xu, 2021; Michney, 2022). However, much of these discussions—both academic and popular—have remained narrowly focused on the map grades themselves, neglecting the data in the description sheets. This is unfortunate because these data provide unparalleled access into the governing ideology of the real-estate industry of the time. Indeed, it is difficult to make much sense of the maps apart from their notes.

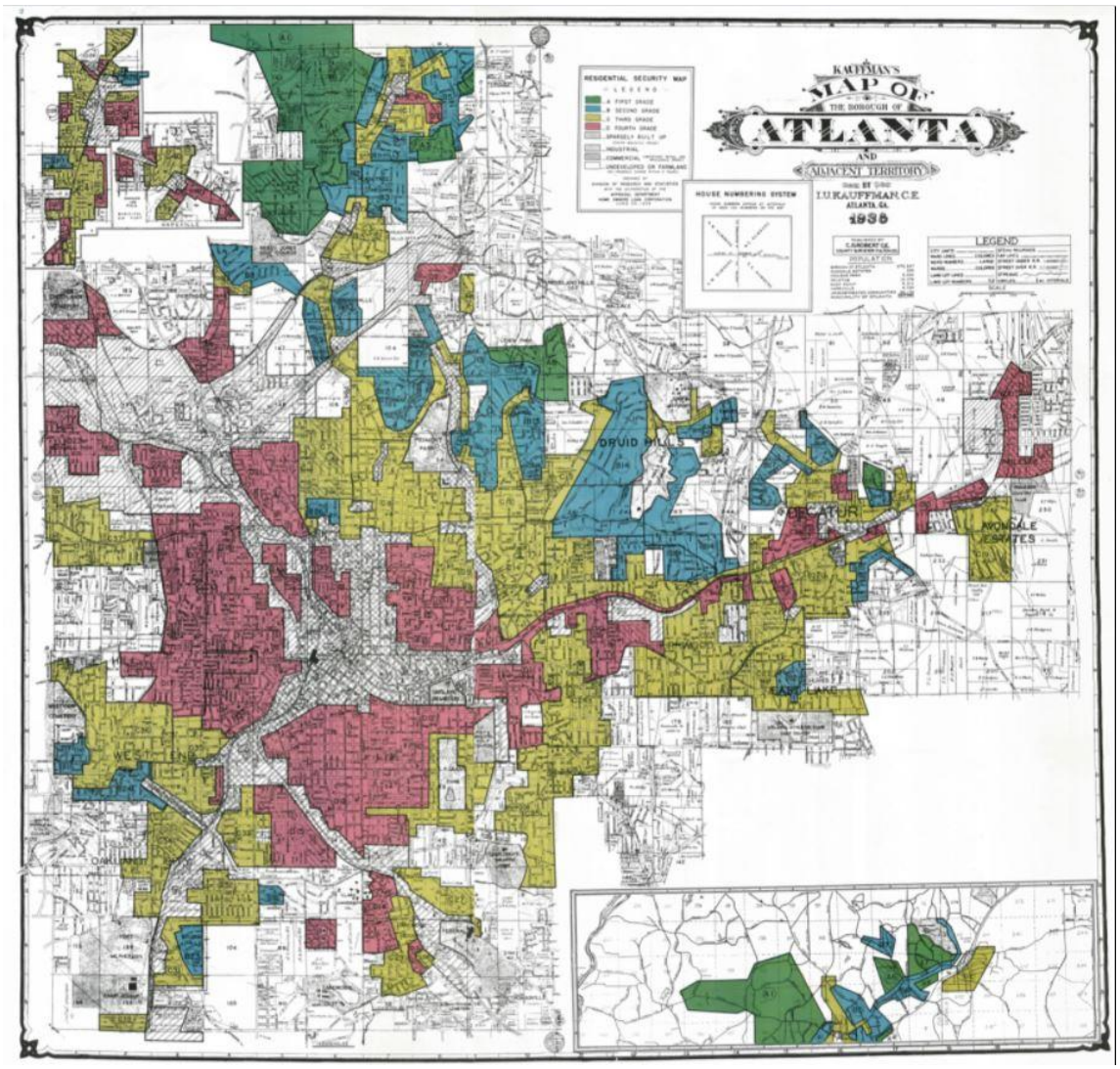


Figure 4.1. Atlanta HOLC map. Source: Nelson et al., 2022

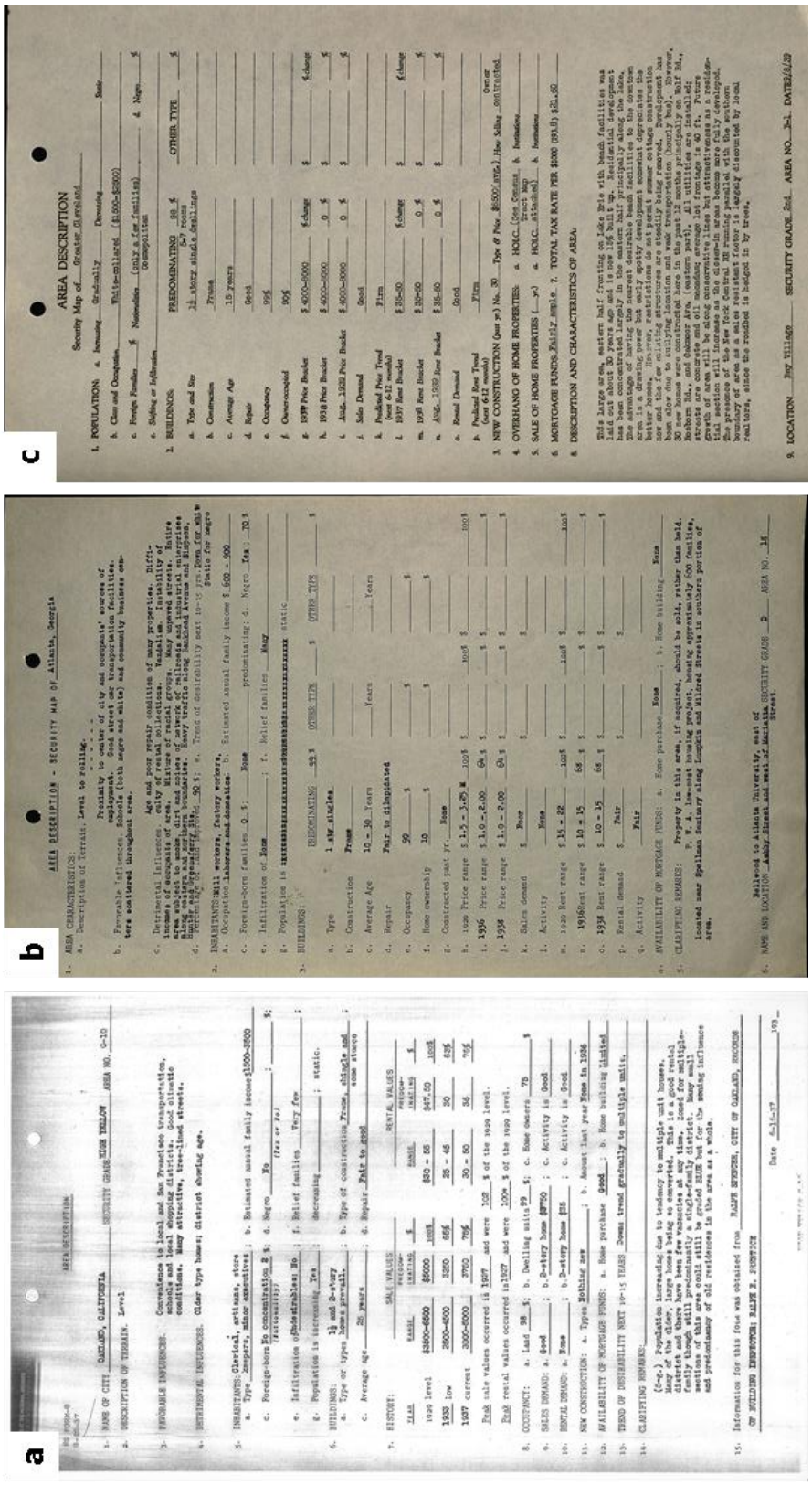


Figure 4.2. Area description sheets for (a) Oakland, CA (early37), (b) Atlanta, GA (late37), and (c) Cleveland, OH (x3940). Source: Nelson et al., 2022

A major reason researchers have tended to ignore the area description sheet (ADS) data is that they are much less accessible than the maps. Although the Digital Scholarship Lab (DSL) at the University of Richmond has digitized the ADS data for well over one hundred cities (Nelson *et al.*, 2022), the data remains unusable without committing substantial time and effort. Some researchers have expended the energy to extract some of the ADS data for their own analyses (e.g., Hillier, 2005a; Greer, 2012; Fishback *et al.*, 2020; Aaronson, Hartley and Mazumder, 2021), but they have only done so for a handful of cities and have not made this data publicly available.

Correcting this, I convert the ADS data into a usable and analyzable tabular format. While I tabulate all variables in an Excel Workbook, I fully prepare eight for statistical analyses. These eight were among the most consequential for determining neighborhood grades (Hillier, 2005; Greer, 2012; Michney, 2022). They include the Black population percentage, "foreign-born" population percentage and group, family income, occupation class, average building age, home repair status, and mortgage availability. I also provide a binary variable indicating whether the HOLC appraiser mentioned the neighborhood's suitability for a Federal Housing Administration (FHA) loan. These tables and accompanying GeoJSON and Esri shapefile polygons—as well as the *R* code used to produce them—are freely available at Open Science Framework (OSF).

There are myriad potential uses for these data. They allow researchers to analyze which factors contributed most significantly to the assigning of HOLC grades from the perspective of HOLC appraisers. They also enable investigations into the important but typically overlooked variability within the map grades. Similarly, these data tables allow

qualitative researchers to search key terms, conduct content analyses, and read through the field notes much more efficiently. Beyond studies of the City Survey program, ADS data also offer a unique source of historical population and housing data at the subcounty scale. Although many of the specifics about HOLC's data collection procedures remain clouded in uncertainty—and although HOLC field agents were likely providing ballpark estimates in many cases (see Greer, 2012 and Michney, 2022)—their ADS data can potentially assist historical small area analyses in places that would not receive census tract-level data for several decades (see Markley *et al.*, 2022b). In the following section, I outline the methods used to produce the tabulated data, including a discussion of how the data were gathered and cleaned. Following that, I describe where these data and the code used to generate them can be accessed.

Methods

Data Collection and Organization

The DSL provides all text from each neighborhood's ADS as a single attribute in a GeoJSON file. Within this file, appraiser comments are separated from their respective section numbers with a colon (see section numbers in **Figure 4.2**). Splitting the comments from the section numbers into two distinct columns is a straightforward procedure in *R* and similar programs. The trouble with this data, however, is that the section numbers are not consistent between cities. For example, the "foreign born" entry may be listed in section 1c in some cities but 2c or 5c in other cities (see **Figure 4.2**). Still other variables are completely left off of some versions. The problem here is that I cannot simply rename all "1c" sections as "percent foreign born." I must first identify

each sheet type before applying a customized reclassification schema to each. I do this manually.

Table 4.1 shows the breakdown of the ADS types. The three with a white background are those I keep, while those shaded gray are discarded. Among the latter are neighborhoods with no accompanying description sheet ("none") and those providing only a descriptive paragraph ("para"). Among the former are the three sheet types corresponding with the dates printed on them: early 1937, late 1937, and 1939–40. Their formats are displayed side-by-side in **Figure 4.2**.

Table 4.1. HOLC area description sheet (ADS) types.

ADS Type	Cities	N'hoods
early37	56	2,068
late37	55	2,118
x3940	18	2,574
para	26	836
unique	1	27
none	46	1,251

Following manual identification, I proceed with reclassification. I keep section number renames as consistent as possible across sheet types, but their descriptions were sometimes altered by the HOLC, making an exact, one-to-one crosswalk challenging to construct. The output of this initial cleaning process is an Excel workbook called "ADS_organized.xlsx," which is located in the DATA_DOWNLOAD/TABLES folder in the associated OSF project. The ADS types are located in separate sheets within the workbook. Column headings are the reclassified names of section numbers, and the cells are filled with the digitized entries provided by the DSL. This organized description sheet workbook is useful for researchers who wish to link variables between sheet types. It also

provides a searchable table to assist with qualitative research. However, it cannot yet be used in statistical analyses.

To prepare analyzable tables, I convert the eight variables mentioned above. These variables are included in all three ADS types, and they are among the field note entries that have generated the most discussion since Jackson's (1980) original work. The three descriptive variables (excluding the "foreign-born" group)—repair status, occupation class, and mortgage availability—are used to impute some of the missing numerical variables, so I discuss them first.

Tabulating Descriptive Variables

For home repair status and mortgage availability, appraisers generally stuck to ordinal descriptors like "good," "fair," "bad," and so on. Often though, they used multiple, conflicting descriptors like "good in west, bad in east," "good-to-fair," and so on. To sort through these, I establish a two-step process. First, I identify the descriptors corresponding with "positive," "middle/mixed/ conditional," and "negative," and assign them a binary indicator that specifies which of these three positive-to-negative categories their descriptions fall into. Then, I build a six-category ranking schema based on which indicators are present for which categories. For repair status, for example, the presence of a standalone positive indicator earns that neighborhood a grade of "Good." The presence of a positive and middle indicator earns it a grade of "Fair-Good," and so on. Neighborhoods with a positive *and* a negative descriptor or all three are assigned a middle grade of "Fair," and those missing data or with inconclusive descriptors are classified as "Other/NA." **Table 4.2** shows how different key terms listed by the HOLC appraisers were initially classified.

Table 4.2. Home repair and mortgage availability key terms grouped by positive-negative categories.

Classification	Repair Key Terms	Mortgage Availability Key Terms
Positive	Good, excellent, best, new, first class, well kept, pride of ownership	Ample, best, favorable, good, plentiful, plenty, yes, available
Middle/Mixed/ Conditional	Fair, fine, medium, varied, spotty, all varieties/kinds/ conditions, new but cheap	Limited, fair, select, small, little, conservative, some, questionable, slow, available up to/only at XX%, upon credit check, low ratio, where sewer exists, singles
Negative	Bad, poor, terrible, rotten, dilapidated, repairs needed	Very limited/little, scarce, nominal, doubtful, hard to get, poor, meager, difficult, restricted, none, nil, no, not available

Occupational class presents a different challenge. Most entries do not have a clear ordinal ranking. I therefore establish my own classificatory system in the same manner described above. I first group occupational descriptions into "upper," "middle," and "lower" classes because these descriptors were commonly used by field agents. However, when field agents listed occupations without a corresponding class indicator, I must make my own determinations about how to group them. **Table 4.3** shows how I classified these occupational key terms. Following this step, I spread these into a six-category variable based on the neighborhood mix.

Table 4.3. Occupation key terms grouped by occupational class categories.

Occupational Class	Occupation Key Terms
Upper	Upper class/bracket; professionals; white collar; executives; railway officials; businessmen; large/high income; better people; high class; wealthy; best; good; better families; manufacturers; managers; capitalists; millionaires

Middle	Middle class; merchants; shopkeepers; artisans; better paid employees; grocers; superintendents; teachers; skilled mechanics; clerks; office, salaried, skilled, clerical, service workers
Lower	Lower class/grade; working class/people/men; cheap labor; servants; gardeners; firemen; truck drivers; shop men; miners; chicken ranchers; squatters; on relief; drifters; wage earners; homesteaders; tradesmen; the worst; parasites; steel, industrial, railroad, oil well/refinery, farm, rural, rubber, flat, ordinary, common, packing plant, marble, daily workers

The distributions of these descriptive variable categories by HOLC grade are shown in **Figure 4.3**. Each, more or less, conforms to expectations. "A" neighborhoods have the highest share of "Good," "Ample," and "Upper" descriptors and the lowest share of "Poor," "Restricted," and "Lower" descriptors. These distributions shift in "B" and "C" neighborhoods—which have successively higher shares of the middle categories—until they are completely reversed in "D" neighborhoods. However, it bears repeating that the precise methods field agents used to acquire this information remains unclear. Surviving correspondence suggests they were relying on some combination of local administrative and business records, informal surveys, reconnaissance, and personal impressions. These data gathering approaches were also inconsistently applied across cities and likely varied between individual appraisers (see Greer, 2012; Michney, 2021).

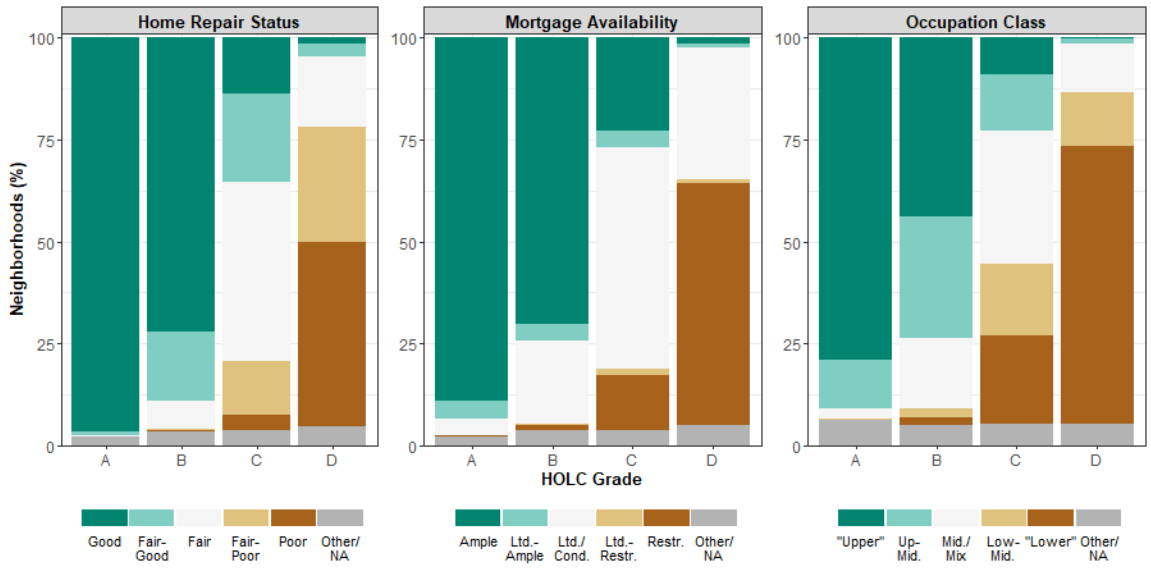


Figure 4.3. Distribution of the qualitative descriptors across HOLC neighborhood grades.

Tabulating Quantitative Values

Converting digits in a string to numbers is a basic task in most data processing software programs. For the majority of the cases in this dataset, that is all that is required. Making matters more complicated, however, are a variety of inconsistencies in how HOLC appraisers entered their numerical values. Some spelled numbers out (e.g., “two”); wrote fractions (e.g., 2 ½); responded with “no,” “N/A”, or “none;” listed the number of families rather than percentages; described a quantity (e.g., “few”); or provided ranges. The first three of these instances require only identification and numerical conversion. And for “families”—which were sometimes listed in the Black and “foreign-born” entries—I conservatively assume that one family translates to 0.5 percent of the neighborhood population.

These steps provide numerical percentages for about 98 and 94 percent of the Black and “foreign born” data entries, respectively. Left over are cases in which the

appraiser used a quantitative descriptor like “few”, “nominal”, “many”, or “some.” **Table 4.4** displays a breakdown. To convert these, I first identify the description sheets that include one of these descriptors alongside a numerical percentage—e.g., “few 5%.” This is surprisingly common because of the sheet design. With this data, I then calculate the mean percentage associated with each descriptor. The resulting estimates indicate the average percentage appraisers understood a given descriptor to represent. However, since there was pronounced neighborhood and regional differentiation in where Black and “foreign-born” populations lived at the time, I calculate these means by neighborhood grade (where possible) and region, where region is defined using the Census definition with one minor modification.[7] In cases with less than three data points, I use the national average. When there are less than three national data points, I generate my own estimates (e.g., “several” = 10%). All neighborhoods with an imputed Black or “foreign-born” value are indicated with a flagged binary variable.

Table 4.4. Quantitative descriptors in the HOLC area description sheets. The n value represents the number of sheets with one of these descriptors and no accompanying numerical percentage.

Descriptor	% Black (n)	% For. Born (n)
few	63	242
mix, mixed, mixture, or various	0	27
negligible	0	1
several	1	0
small	2	5
some	4	5
substantial	1	3
threatening	1	1
very few	10	33
yes	23	6

[7] I reclassify Baltimore, MD from the South to the Northeast.

[nationality]	0	46
Total	105	376

Following this step, I account for 100 percent of the Black population entries and over 99 percent of the "foreign born" entries. There remain 46 cases in which the appraiser listed only a nationality with neither a numerical percentage nor a quantitative descriptor. These are handled below.

For both the average building age and family income, appraisers commonly recorded a range rather than a single numerical value (e.g., 1–15 years; $2500–3000). In such cases, I take the midpoint (e.g., 8 years; $2750). This strategy, in combination with meticulous manual checks and overrides, works well in most cases. However, it still leaves 232 (3.5%) building age entries and 1,850 (27.6%) income entries empty. The latter number is so high because there was no official "family income" category for *x3940* cities, though appraisers often listed an income along with the occupation. To impute these missing values and the few with no "foreign-born" variables, I generate estimates with linear regressions. The covariates include other relevant variables in the dataset, a geographical control, and the HOLC grade. The regression equations used to impute each of these variables are:

$$log(Fb) = \beta_0 + \beta_1(St) + \beta_2(Occ) + \beta_3(Rep) + \beta_4(Mor) + \beta_5(B) + \beta_6(G) \quad (4.1)$$

$$\log(Inc) = \beta_0 + \beta_1(Reg) + \beta_2(Occ) + \beta_3(Rep) + \beta_4(Fb) + \beta_5(B) + \beta_6(G) \quad (4.2)$$

$$\log(Age) = \beta_0 + \beta_1(St) + \beta_2(Rep) + \beta_3(Inc) + \beta_4(Fb) + \beta_5(B) + \beta_6(G) \quad (4.2)$$

where Fb is the "foreign-born" percentage, Inc is the income, Age is the building age, St is the state, Occ is the occupation class, Rep is the repair status, Mor is mortgage availability, B is the Black percentage, G is the HOLC grade, and Reg is the region . Ideally, the smallest geography available above the neighborhood—the metropolitan area—would be used as the geographical control. However, since these variables are frequently missing from entire cities or states, I use the smallest geographical control permitted. For models (1) and (3), that is the state. For model (2), that is the region.

To ensure the residuals are normally distributed, I run each regression twice. After the first round, I remove all residual outliers and then run the regression again. The estimates produced from the second round are the ones used to impute the missing values. The residual density plot and histogram for each model is reported in Appendix A (**Figure 4.4**). Each appears close to normal. To help with data quality control, neighborhoods with imputed values are marked in the final output table with a flagged binary variable to allow users to treat these cases as they see fit. The table also includes the margins of error for imputed values, calculated using a 90 percent confidence interval.

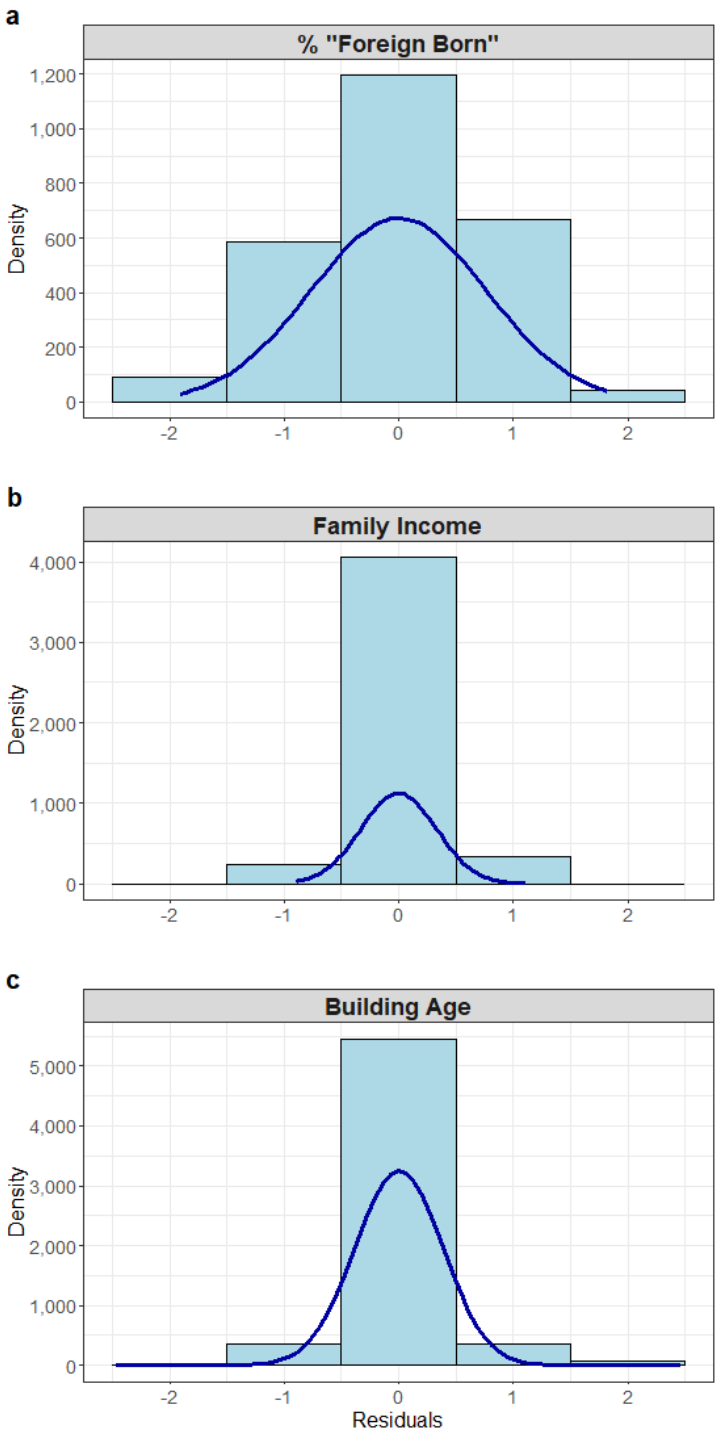


Figure 4.4. Residual density plots and histograms for the three regression models used to impute missing (a) "Foreign-born" percentages, (b) family income midpoints, and (c) building age midpoints

Figure 4.5 shows the distribution of the quantitative variables by HOLC grade and region. As above, each resembles what we would expect given the literature on the City Survey program. Neighborhoods with Black residents were almost uniformly given a "D" grade. Those with "foreign-born" residents were also more likely to receive a lower grade, especially in the West where a higher proportion of "foreign-born" residents came from East Asia, the Philippines, Mexico, and Central America. And consonant with the literature (Greer, 2012; Hillier, 2005), grades appear to be generally positively correlated with incomes and negatively correlated with building ages.

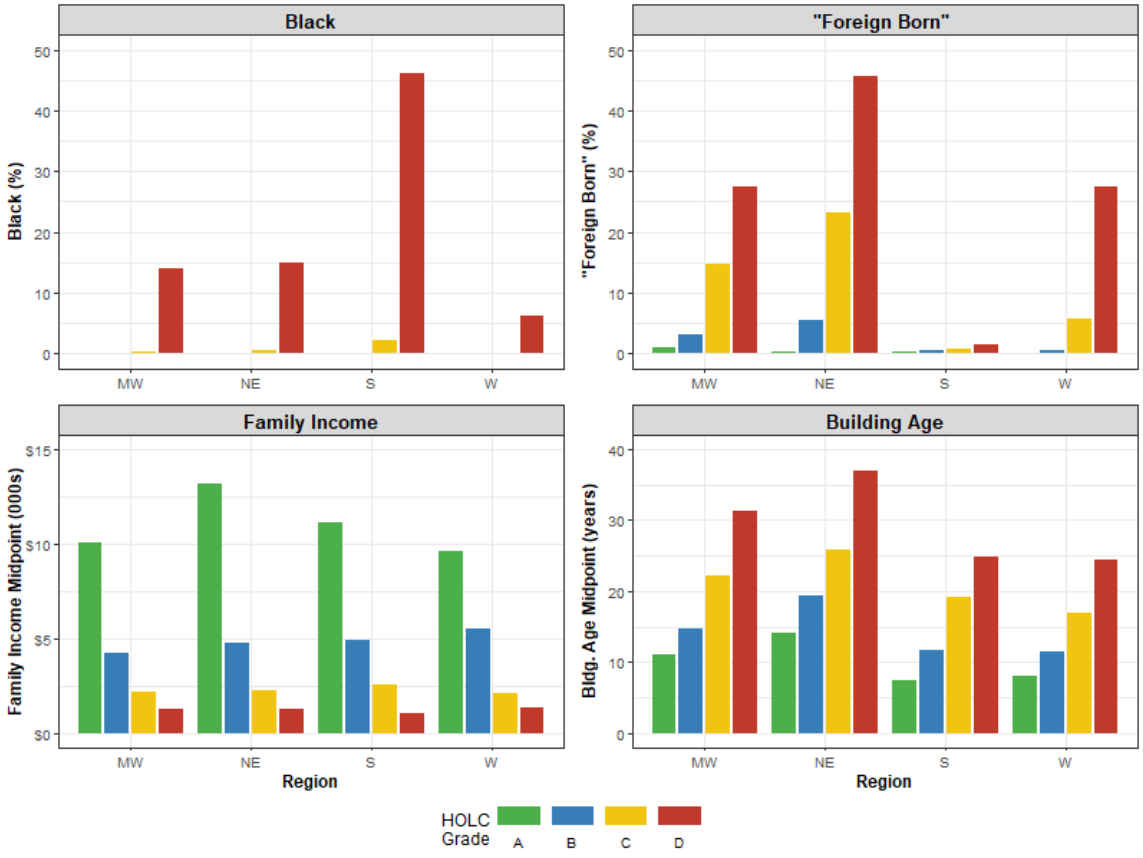


Figure 4.5. Quantitative variables by HOLC grade and region.

The final variable to discuss in this section is the "foreign born" group. This categorical variable is created by extracting the nationalities listed in the "foreign born" entry on the ADS. Using string identifiers, researchers can selectively analyze neighborhoods by the specific population group(s) mentioned. **Figure 4.6** is built doing just that. The "Total" bar represents the grade distribution of all HOLC neighborhoods across the 129 cities included. The "None" bar immediately to its left includes only neighborhoods that do not mention the presence of any Black or "foreign born" residents. The rest show the grade distributions for neighborhoods explicitly mentioning the ethnic, racial, or national group indicated on the x-axis, regardless of its percentage.

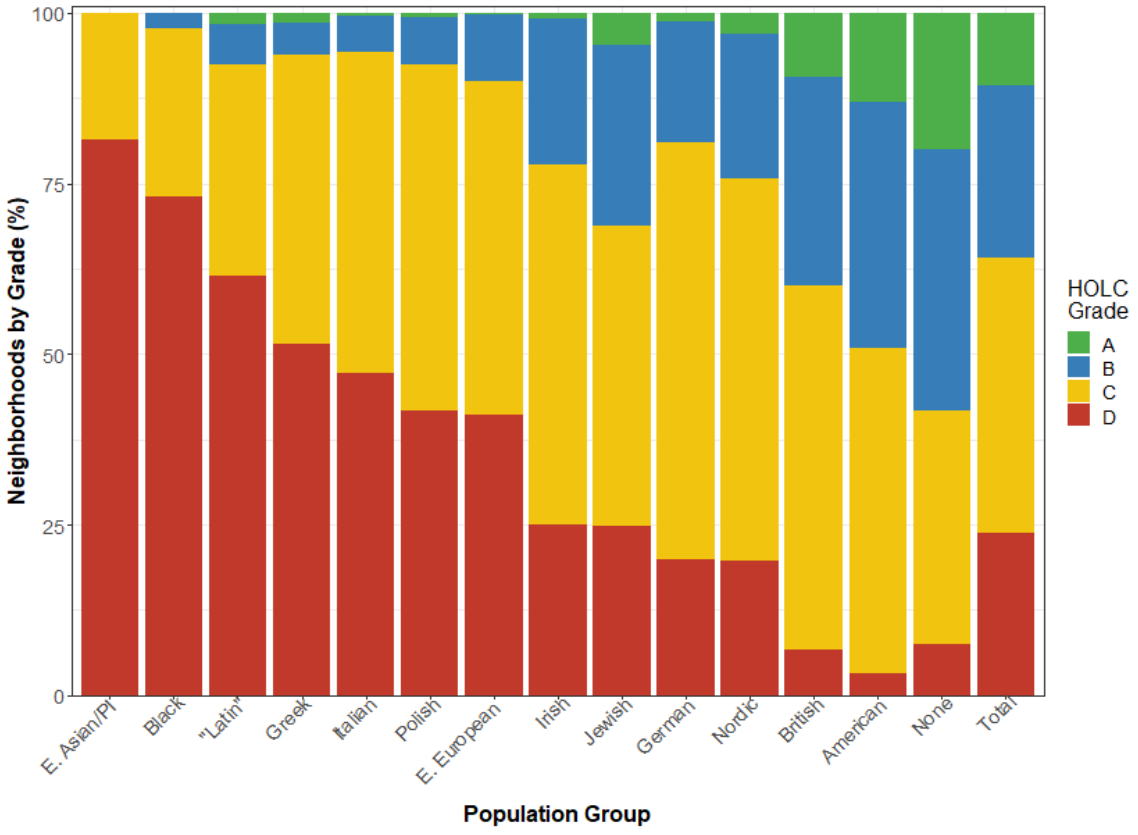


Figure 4.6. Population groups by HOLC neighborhood grade.

Again, **Figure 6** mostly conforms with expectations. Neighborhoods where "whiter" "foreign-born" groups were listed were generally less likely to be assigned a "D" grade than areas with East Asian or Pacific Islander, Black, "Latin", or Southern or Eastern European populations, respectively. With the other variables in the final dataset, users can add statistical nuance to this observation and related inquiries. They can also investigate the HOLC maps' intra-grade variability, shine new light on HOLC's neighborhood appraisal process, and supplement other historical data sources.

Output Data and Code Availability

The final, fully processed data table is called "ADS_FINAL.csv," and it is located in the DATA_DOWNLOAD/TABLES folder in the OSF repository. **Table 4.5** breaks down its variables. This folder also includes the initial tabulated ADS entries (ADS_organized.xlsx), which can help researchers process other ADS variables, as well as summary statistics (Sum_Stats.csv), the regional breakdown (Cities_by_Region.csv), and ADS type and coverage information (HOLC_Cities.csv).

Table 4.5. Variables in ADS_FINAL.csv and their descriptions. Variable types are separated by function.

Variable	Description
Geographic Indicators	
UNIQUE_ID	Unique neighborhood identifier
STATE	State in which HOLC neighborhood is located
CITY	City of HOLC neighborhood
METRO	Metropolitan area (2013 US Census definition) of HOLC neighborhood
HOLC_GRADE	HOLC letter grade
HOLC_ID	City-specific HOLC unique identifier
REGION	Region of HOLC neighborhood: Northeast (NE), Midwest (MW), South (S), and West (W)
ADS_TYPE	One of six ADS formats (see Table 1)
Cleaned Variables for Analysis	
P_BLACK	% Black

P_FB	% “foreign-born”
FB_GROUP	Nationalities of “foreign-born” populations
OCC_CLASS	Occupational class: Upper, Up_Mid, Mid_Mix, Low_Mid, Lower, Other_NA
MID_INC	Family income midpoint
MID_AGE	Building age midpoint
REPAIR	Home repair status: Good, Fair-Good, Fair, Fair-Poor, Poor, Other_NA
MORT_AV	Mortgage availability: Good, Fair-Good, Fair, Fair-Poor, Poor, Other_NA
MORT_FHA	Binary indicating whether the neighborhood was (1) or was not (0) explicitly recommended for FHA loans
Quality Check	
BLACK_TXT	ADS text for P_BLACK
FB_TXT	ADS text for P_FB and FB_GROUP
OCC_TXT	ADS text for OCC_CLASS
INC_TXT	ADS text for MID_INC and for OCC_CLASS for *x3940* neighborhoods
MORT_TXT	ADS text for MORT_AV
B_FLAG	Binary indicating imputation for P_BLACK using key words
FB_FLAG	Binary indicating imputation for P_FB using key words or regression
INC_FLAG	Binary indicating imputation for MID_INC using regression
AGE_FLAG	Binary indicating imputation for MID_AGE using regression
FB_ME	Margin of error for P_FB values imputed with regression (90% CI)
INC_ME	Margin of error for MID_INC values imputed with regression (90% CI)
AGE_ME	Margin of error for MID_AGE values imputed with regression (90% CI)

The DATA_DOWNLOAD directory also hosts two other folders. There is one called “BAR_GRAPHS,” which contains all bar graphs included here. The other is called “SHAPES,” and it houses an Esri shapefile and identical GeoJSON file. These both include the HOLC neighborhood polygons gathered from the DSL, along with a unique neighborhood identifier and the data described herein. All *R* code used to produce these tables, GIS files, and figures—as well as an HTML interactive map not included in the repository—can be found in the “scripts” folder in the same repository.

SECTION III

Empirics

CHAPTER 5

RACE AND VALUE IN SPACE AND TIME: A CRITICAL NARRATIVE CARTOGRAPHY OF THE HOME OWNERS' LOAN CORPORATION'S RESIDENTIAL SECURITY MAPS[8]

[8] Markley, Scott. To be submitted to *Urban Geography*.

Abstract

In Chapter Two, I argued that the racist theory of value (RTV) was developed to impose order and predictability onto the urban housing landscape. In this chapter, I illuminate what its application actually looked like in practice. Specifically, I explore how field agents employed by the Home Owners' Loan Corporation (HOLC) in the late 1930s narrated the spatiotemporal relationships between race and value at the neighborhood level in Milwaukee, WI and Atlanta, GA. To conduct this inquiry, I combine two qualitative approaches—critical cartography and narrative analysis—to develop a method I call critical narrative cartography. With this framework, I read HOLC's City Survey program not as a redlining project but as a nascent spatial data science operation devised to improve the ability of both the state and real estate capital to anticipate neighborhood value trends. The cartographic narratives communicated through the maps and their accompanying notes, I argue, reflect how twentieth-century real estate capital was coming to understand the connections between race and value in (urban) space and time at a key moment in its development. In particular, they reveal a conception of value that is highly contingent on a neighborhood's current and projected racial composition.

Introduction

In this chapter, I illuminate one way the racist theory of value (RTV) was put into action. To do that, I turn to the maps and Area Description sheets produced in the late 1930s by the Home Owners' Loan Corporation (HOLC). As products of a public-private partnership between the federal government and the real estate industry, these archival documents provide a unique look into how real estate capital viewed the link between race and value in space and time. Accordingly, they include important clues about what

the RTV looked like in practice. Unlike the regularly cited textbook and policy document excerpts that advocate the RTV in the abstract such as those from the Federal Housing Administration's (FHA) *Underwriting Manual* or the National Association of Real Estate Boards' (NAREB) *Code of Ethics*, the HOLC maps and notes show how field agents—working for a state agency on behalf of real estate capital—linked specific neighborhood attributes in concrete places to the (projected) value of residential properties in them. They are thus especially well-suited to demonstrate the crucial but often overlooked spatiotemporal and relational qualities of the RTV.

To pursue this investigation, I ask the question: **How did HOLC's field agents narrate a neighborhood's prospective returns on property investment?** This framing calls for a methodological approach that can give adequate weight to both the HOLC maps themselves and to the stories HOLC field agents told about the race-value connection in the places they appraised. I therefore combine elements of critical cartography (see Crampton and Krygier, 2006) and narrative inquiry (see Chase, 2005) to explore the cartographic narratives told about places in the maps and notes. These approaches share several similarities. Among them are a focus on the social position of the mapmaker/narrator, the intended audience, the intended purpose, what is depicted/said/written, and what is omitted. Especially pertinent for my purposes, though, is that critical cartographers and narrative inquirers respectively hold that maps and narratives are situated, power-laden forms of knowledge that reflect a particular way of seeing and presenting the world. Bringing these approaches together therefore allows me to connect the microevent of the HOLC neighborhood appraisal to the macroprocess of racial capitalism.

I conduct this critical narrative cartography with the HOLC maps and notes from two cities: Milwaukee, Wisconsin and Atlanta, Georgia. Separated by geography, political economy, and racial/ethnic history, these places present an instructive set of contrasts that highlight the myriad ways HOLC appraisers expressed their understanding of value in space and time. Approaching these cities' maps and notes as components of a data gathering and assessment operation, I find that appraisers employed two principal narrative types in their efforts to project neighborhood-level values. The first—which I call "Temporal Narratives"—situated HOLC neighborhoods in time, placing them along a past and projected value trajectory. In Milwaukee, Temporal Narratives were frequently deployed to describe the current or anticipated "infiltration" of certain groups, particularly Jewish residents and non-German immigrants. The second narrative type—which I call "Proximity Narratives"—situated HOLC areas in space, projecting value based on how near or far certain dis/amenities, including non-white residents, were from it. In Atlanta, Proximity Narratives commonly framed Black residential presence as an active detriment to white property values. Together, these spatiotemporal narratives suggest how twentieth-century real estate capital incorporated race into their value assessments.

This chapter is organized across seven sections. The first two provide some background about the formation of HOLC as a short-lived federal agency and position it, along with its City Survey program, within its broader social, political-economic, and institutional context. Here, I posit that the City Survey program was more about collecting and analyzing housing data to project neighborhood values than about instituting discriminatory lending practices. Next, I turn to the methods. In this section, I

define critical narrative cartography and describe its utility for reading HOLC's maps and field notes. With that framework, I then proceed with the next three sections, which discuss the study area, navigate the maps themselves, and elucidate the cartographic narratives of value told by the maps and notes, respectively. Finally, I summarize my findings and offer a path for future inquiry in the conclusion.

The Home Owners Loan Corporation

One month after his inauguration, Franklin Roosevelt urged Congress to adopt a measure that would stem the tide of foreclosures that was sweeping through the United States. Two months later, in June of 1933, the Home Owners' Loan Corporation was created. Today, HOLC is most often associated with a series of "residential security" maps produced under its City Survey program to assess neighborhood-level risk factors faced by property owners (Jackson, 1980, 1985; Freund, 2007; Rothstein, 2017; Michney and Winling, 2020). These maps use an A-to-D grade range that colors the lowest rated neighborhoods—*i.e.*, those presumed to present the most risk to property owners—red and in earlier versions, labeled them "Hazardous." Largely because of this color choice and due to some misinterpreted speculations made by Kenneth Jackson (1980; 1985) in the 1980s, the HOLC maps have been somewhat speciously associated with the practice of redlining, wherein lenders, insurers, and other firms dealing in real estate systematically exclude or overcharge residents living in those areas (see Chapter Three). Though reflecting a logic consistent with that of redlining, it is worth clarifying up front that the HOLC maps themselves were not actually used to *do* redlining as far as historians of the City Survey program know (Hillier, 2003a, 2005a; Crossney and Bartelt, 2005a, 2005b; Michney, 2022).

The agency's initial purpose, however, had little to do with mapmaking. In fact, the secretive City Survey program did not even begin until 1935, and the final versions of the maps were not published until between 1937 and 1940 (Hillier, 2005). Rather, as Roosevelt proposed, HOLC was originally tasked with bringing down the country's skyrocketing foreclosure rate and relieving troubled financial institutions (Harriss, 1951; Crossney and Bartelt, 2005a; Freund, 2007; Rose, 2011; Michney and Winling, 2020). Housed within the Federal Home Loan Bank Board (FHLBB), which was established in 1932 under Herbert Hoover's administration to oversee and advise the country's Savings and Loan institutions (S&Ls), the HOLC sought to accomplish this by issuing government bonds to purchase home mortgages facing default. The agency then refinanced the mortgages on terms that extended the life of the loan and reduced interest rates, lowering borrowers' monthly payments (Harriss, 1951; Rose, 2011). S&Ls received cash for the delinquent loans on their books, and hundreds of thousands of urban homeowners facing foreclosure were able to stay in their homes (*ibid*.).

The HOLC refinancing program was highly experimental at the time. Nothing like it had existed in US history, and though in need of relief, many industry leaders were wary about what such an unprecedented intervention from the federal government could mean for them down the line (Freund, 2007). As part of the government's negotiations with these business interests, the law signing HOLC into existence mandated that the refinancing program only operate from 1933 to 1936. Over that short time, the corporation loaned over $3 billion to over a million homeowners, one-fifth of the US's non-farm, owner-occupied housing units with mortgages (Harriss, 1951). Before the program terminated, the HOLC was the single largest holder of mortgages in the country

(Greer, 2012). And due to the acquisition of close to 200,000 foreclosed and donated properties over its lifespan (Harriss, 1951), HOLC soon also became the largest owner of urban real estate in the US (Hillier, 2005). This presented challenges for the agency because it was set up for the narrow task of refinancing loans, not for getting into the business of renting and selling property. But this is exactly what it started to do.

By 1934, HOLC was contracting with thousands of more workers to handle home appraisals, repairs, management, and sales (Harriss, 1951; Woods, 2012). Its expanding real-estate portfolio also led to mounting pressure from higher-ups at the FHLBB to implement new "scientific" appraisal standards (Stuart, 2003; Woods, 2012). In 1934, the *Federal Home Loan Bank Review*—the FHLBB's publication that it circulated to its thousands of member institutions—identified "faulty appraisals," a "lack of uniformity in practices and in standards for home financing institutions," and an indifference to the "stability of the neighborhood" in assessing property risk as three of the eight major weaknesses of the pre-Depression national banking system (Woods, 2012, p. 1040). Possibly to help address these concerns and to improve HOLC's management, appraisal, and sale of its growing cache of residential properties, the FHLBB—not HOLC—launched the City Survey program in 1935 (Hillier, 2005a; Howell, 2015; Michney and Winling, 2020). In fact, as many of the residential security maps themselves plainly show—usually near their legends—the program would (eventually) be carried out by FHLBB's Division of Research and Statistics "with co-operation of the Appraisal Department" of the "Home Owners' Loan Corporation" (see Nelson *et al.*, 2022). In this way, HOLC's maps and notes may best be conceived as an internal data gathering and assessment operation designed more for exploration than implementation.

The City Survey Program

Institutional Context

Using paid HOLC staff as well as locally contracted realty and lending agents, the City Survey program created residential security maps for over 230 cities across the US (Hillier, 2003a). The maps relied on a now-infamous A-to-D neighborhood grading schema that colored neighborhoods green, blue, yellow, and red, respectively. The maps for Milwaukee and Atlanta are presented in **Figures 5.1** and **5.2**. In earlier versions, these grades were called "Best" (A), "Still Desirable" (B), "Definitely Declining" (C), and "Hazardous" (D), a fact that has been repeatedly highlighted in the HOLC literature since Jackson's (1980; 1985) original work. These labels are notable because they ascribe temporal meaning to the map grades, evoking a Babcockian (1932) theory of inevitable neighborhood decline (see Chapter Two). The labels for both B and C neighborhoods explicitly denote time, while the "Hazardous" grade directly following the "Definitely Declining" grade suggests an end state. However, despite the widespread attention these labels have received, they are noticeably absent from the maps' final editions as can been seen in the legends of **Figures 5.1** and **5.2**. From 1937 on, the grade labels were changed to "First," "Second," "Third," and "Fourth Grade," respectively.[9]

[9] There is an exception in several cities across Iowa. In Des Moines, Dubuque, Sioux City, and Waterloo, the grades are labeled "Best," "Good," "Fair," and "Bad."

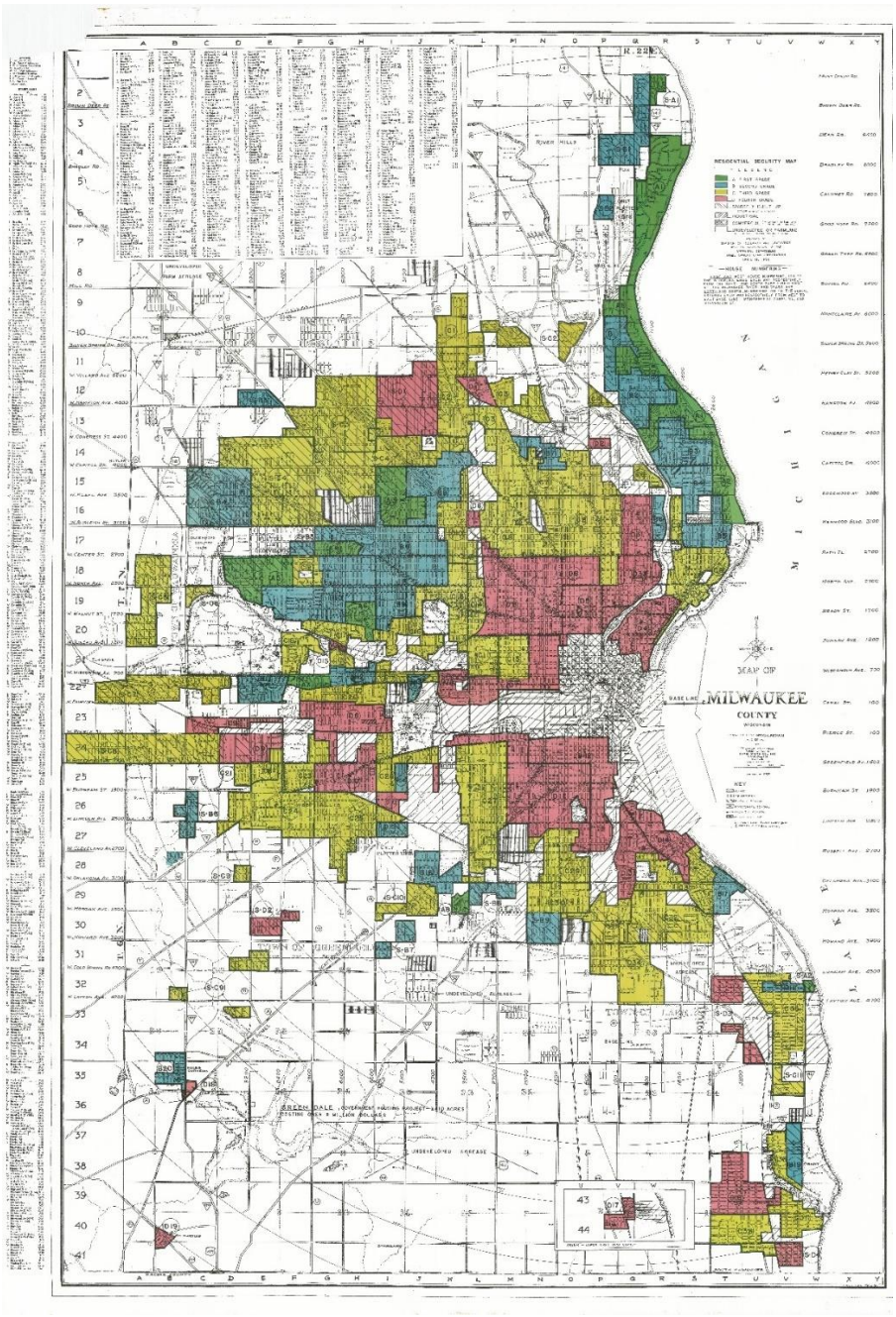


Figure 5.1. HOLC Residential Security map for Milwaukee County, WI (1938). Source: Nelson et al. (2022).

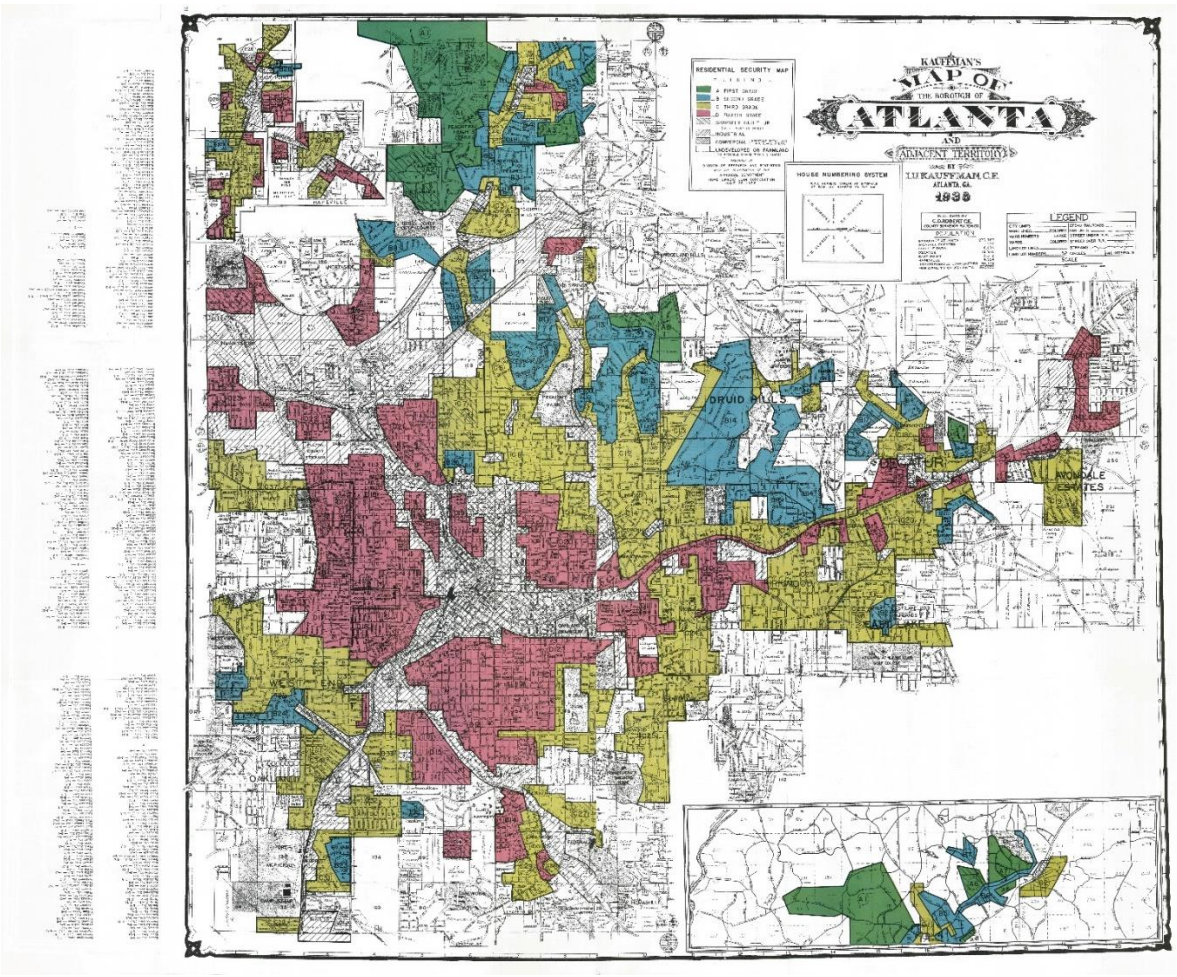


Figure 5.2. HOLC Residential Security map for Atlanta, GA (1938). Source: Nelson et al. (2022)

Though subtle, this change points to an important feature about the City Survey program. In Todd Michney's (2022) archival analysis, he highlights a telling piece of correspondence between several field agents and Corwin Fergus, the manager of the FHLBB's Mortgage Rehabilitation Division and overseer of the mapping program. These agents proposed adding a fifth category to separate B and C neighborhood in large part because they objected to the "declining" label assigned to C-graded places. In their view, many areas that fell into the C category were not really "declining" because lenders were still making loans there, and they would "not like to be known as making loans in

declining areas" (Fergus quoted in Michney [2022, p. 330]). Notably, this correspondence is from January of 1936, near the very beginning of the mapping program. This probably explains why later versions of the map dropped these labels. Thus, while the map grades may have been conceived to signify areas considered Best, Still Desirable, Definitely Declining, and Hazardous, these designations were likely eventually scrapped because they did not sufficiently capture how map grades were being assigned in practice.

Although some scholars have argued otherwise (e.g., Fishback *et al.*, 2020), it is clear that determinations for each neighborhood grade depended heavily on its racial and class compositions. "A" grades (green) were reserved for "homogenous" neighborhoods, meaning white and upper-income, while "D" grades (red) were issued to areas with aging homes in poor repair, low-income residents, and/or African Americans, immigrants, and other people of color (Jackson, 1980; Winling and Michney, 2021). "B" and "C" graded neighborhoods were somewhere in the middle, but as I emphasize in my analysis below, the A-to-D grades were not exactly determined on a linear, good-to-bad scale as is often assumed. For example, as Winling and Michney (2021) have underscored, the presence of Black residents was a sufficient but not necessary factor in appraisers' decisions to give an area a D grade in most cases, regardless of the housing conditions there (see Chapter Three). Furthermore, as I will highlight, there was considerable ambiguity in how these grades were assigned.

A large body of research has asserted that the HOLC maps were used by private lenders and other government agencies to deny mortgage applications for properties in D-graded neighborhoods (see Chapter Three). Yet, the historical record on who actually

referenced the maps suggests that they were likely made for in-house purposes and thus did not circulate far beyond the walls of HOLC and FHLBB offices (Crossney and Bartelt, 2005a; Hillier, 2005; Greer, 2012; Michney, 2022). In fact, despite the widespread attention the maps have garnered in recent years, their exact purpose and data-gathering procedures remain largely unclear.

In his in-depth archival analysis of internal agency correspondence, Michney (2022, p. 318) found that the City Survey program was something of a "shoestring operation in search of a mission." Much of the process, he noted, appears improvised, and the agency's aims and practices changed through the life of the program. Further, although higher ups in FHLBB's Mortgage Rehabilitation Division—which was initially in charge of the City Survey program before being folded into the Division of Research and Statistics—wanted to impose a standardized grading system, data quality and availability varied dramatically between cities (*ibid*.). The result is a series of maps drawn using inconsistent—and opaque—criteria. As Hillier (2003a, 2005a) notes, the map grade boundaries in most places do not conform to locally recognizable neighborhoods. Rather, their sizes, shapes, and configurations differ considerably, and so did the number of people living in them. Additionally, the numerical data provided in the Area Description sheets were likely to be ballpark estimates or anticipated quantities rather than exact counts (Greer, 2012; Michney, 2022; Markley, 2023). Unfortunately, there does not seem to be a dependable way to tell how reliable any given figure is outside acquiring ancillary data, which does not always exist.

There are also questions about what or who the mapping project was actually for. Like many throughout the vast web of private-public real estate interests, FHLBB

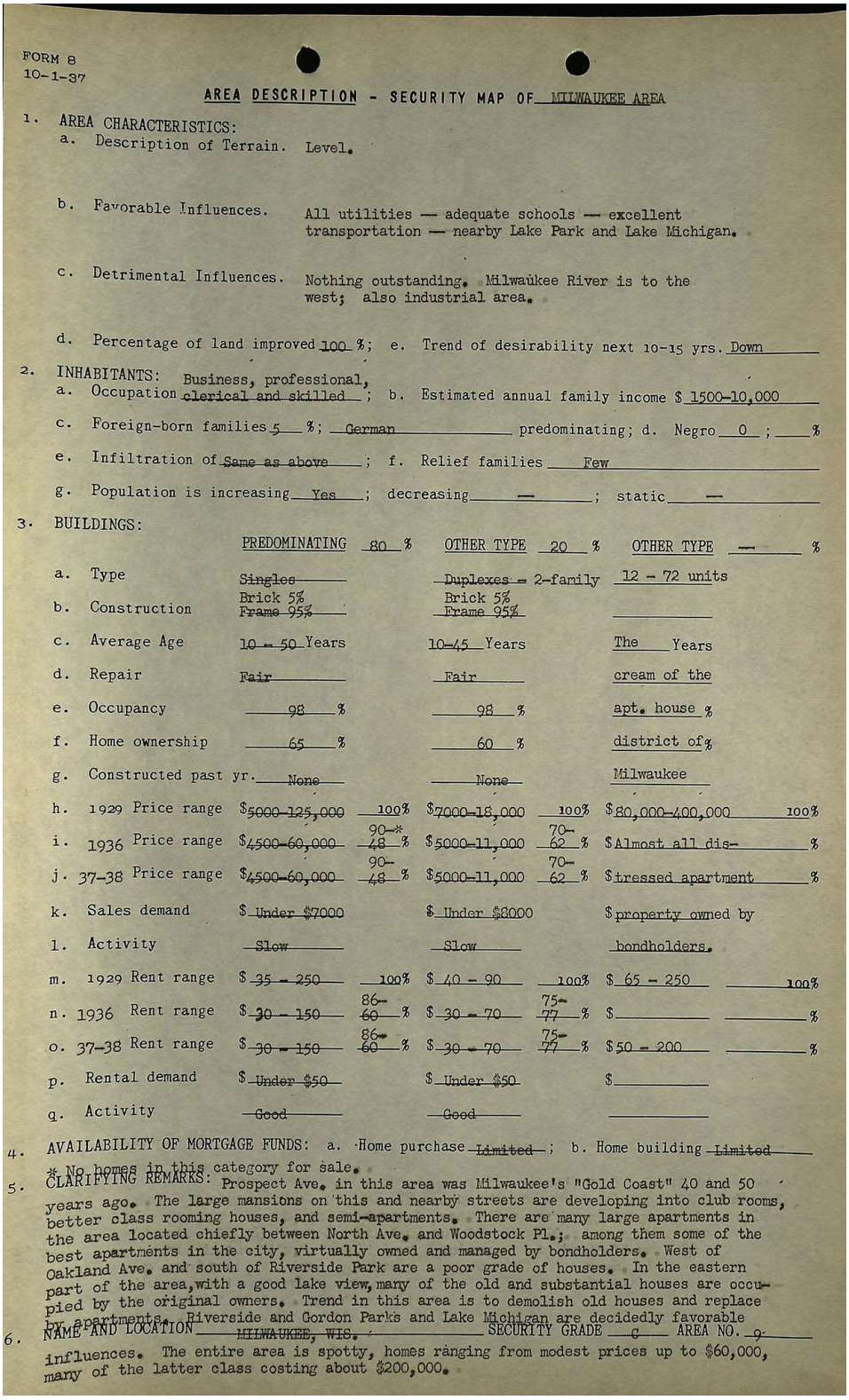
officials wanted to improve the home appraisal process by analyzing neighborhood-level data. But it is not entirely clear who this was meant to serve. Howell (2015) proposes that this was likely for the benefit of HOLC itself, which needed to appraise and sell its massive inventory of acquired properties. Michney (2022) finds some evidence of this in HOLC's internal correspondence, but he suggests that the agency was less concerned with what it already had on its books than what it was anticipating its future role in the mortgage market would be. Again, the City Survey program originated with the FHLBB's Mortgage Rehabilitation Division before being moved to its Research and Statistics division. Headed by men who had previously worked in banking or finance—and collaborating with local bankers, lenders, insurers, and real estate brokers to make the maps and record the data—the program assessed the lay of the housing landscape, so to speak. It prepared the agency to offer data-informed insights that would help their effort to "rehabilitate" (in their words) the country's *private* home financing industry (*ibid*.). The City Survey program was thus, it seems, primarily a fact-finding and data-gathering operation for the FHLBB, which was established to bolster the private home lending business.

Broader Context

Re-envisioning the City Survey program as a data gathering and assessment project on behalf of real estate capital generally and home lenders specifically makes sense when considering three broader developments unfolding at the time. The first, hinted above, was a growing consensus within the real estate profession that property risk evaluation needed more of a basis in "science" (Woods 2012; Winling and Michney

2021). In that respect, the security maps would provide quality local data to better assess that risk. These data were provided not just by the maps themselves but in an attached Area Description sheet that included detailed quantitative and qualitative information on the neighborhood's racial and class compositions; proximity to both noxious land-uses and points of local interest; housing type, age, and condition; housing prices, rents, and their recent trajectories; and general comments the field agent felt were relevant to note (see **Figures 5.3** and **5.4** below). Notably, this growing emphasis on producing better data was paralleled in other government agencies of the time, especially the FHA, Works Progress Administration (WPA), and Census Bureau (Hoyt, 1939; Jackson, 1985; Hillier, 2005a; Woods, 2012; Anderson, 2015).

A reigning belief inside many official circles seemed to be that better data and analysis could have helped forestall the housing fallout of the Great Depression (see Stuart, 2003; Hornstein, 2005; Woods, 2012). In this way, the mapping project itself cannot be understood apart from the effects the Great Depression had on property values. According to Milwaukee's and Atlanta's Area Description sheets, home values had bottomed out in most urban neighborhood soon after their 1929 peak and had yet to recover by the time the maps were drawn in the late 1930s, a fact depicted in Description sheets in **Figures 5.3** and **5.4**. Real estate was understood to be a risky investment, and recent trends in urban real estate prices had been largely negative or stagnant. Quite different from today's environment, the conventional wisdom among property appraisers then was that urban property values were destined to decline in the long run (*e.g.*, Babcock, 1932; see also Harris, 2012). However, there were measures that could be implemented that were widely believed to slow decline and protect home values. These



FORM 8
10-1-37

AREA DESCRIPTION - SECURITY MAP OF MILWAUKEE AREA

1. AREA CHARACTERISTICS:
   a. Description of Terrain. Level.
   b. Favorable Influences. All utilities — adequate schools — excellent transportation — nearby Lake Park and Lake Michigan.
   c. Detrimental Influences. Nothing outstanding. Milwaukee River is to the west; also industrial area.
   d. Percentage of land improved ~~100~~ %; e. Trend of desirability next 10-15 yrs. Down

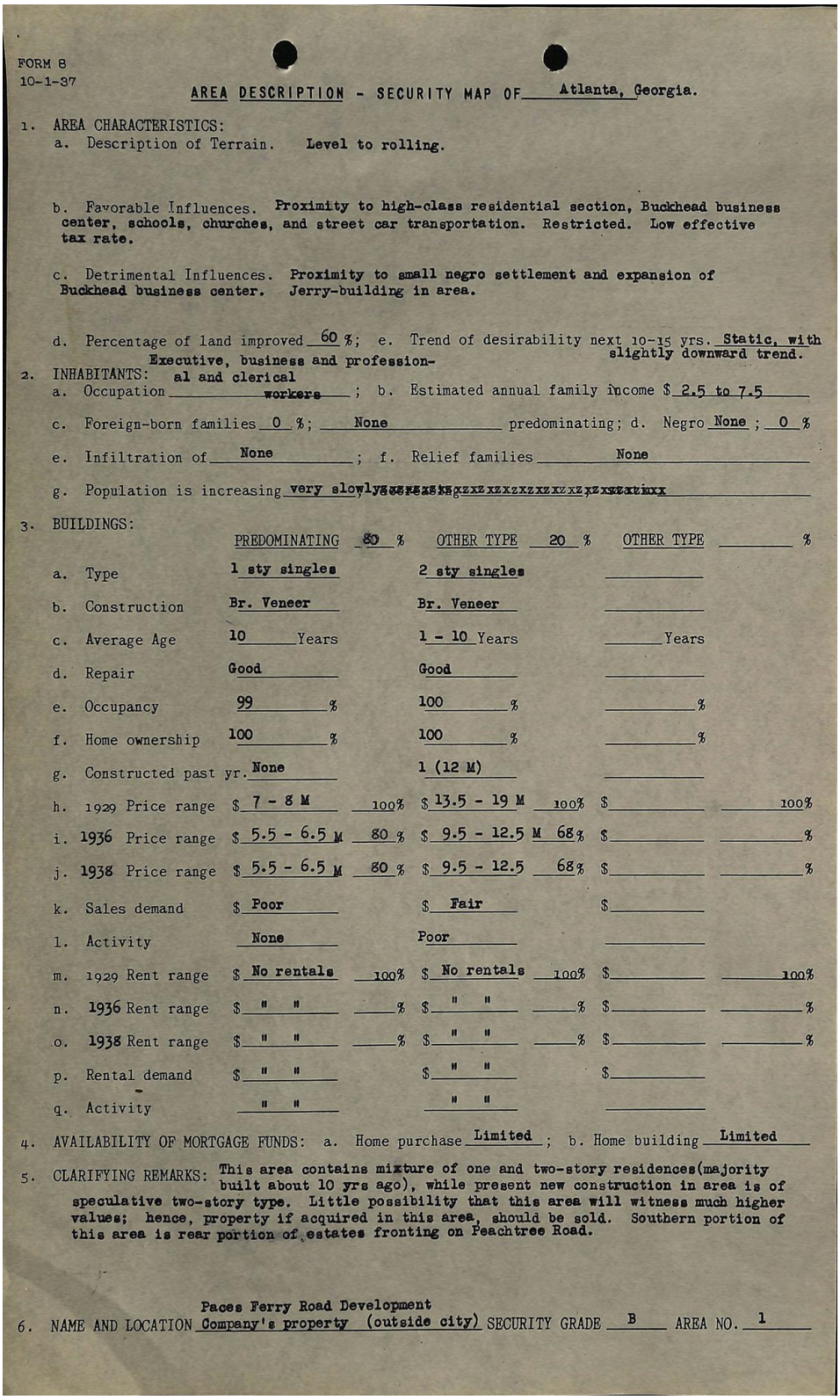
2. INHABITANTS:
   a. Occupation Business, professional, ~~clerical and skilled~~; b. Estimated annual family income $ 1500-10,000
   c. Foreign-born families ~~5~~ %; ~~German~~ predominating; d. Negro ~~0~~ ; ~~—~~ %
   e. Infiltration of ~~Same as above~~; f. Relief families Few
   g. Population is increasing ~~Yes~~; decreasing ~~—~~; static ~~—~~

3. BUILDINGS:

		PREDOMINATING ~~80~~ %		OTHER TYPE ~~20~~ %		OTHER TYPE ~~—~~ %	
a.	Type	~~Singles~~		~~Duplexes - 2-family~~		12 - 72 units	
b.	Construction	Brick 5% ~~Frame 95%~~		Brick 5% ~~Frame 95%~~			
c.	Average Age	~~10 - 50~~ Years		~~10-45~~ Years		The Years	
d.	Repair	~~Fair~~		~~Fair~~		cream of the	
e.	Occupancy	~~98~~ %		~~98~~ %		apt. house %	
f.	Home ownership	~~65~~ %		~~60~~ %		district of %	
g.	Constructed past yr.	~~None~~		~~None~~		Milwaukee	
h.	1929 Price range	$~~5000-125,000~~	~~100~~%	$~~7000-18,000~~	~~100~~%	$~~80,000-400,000~~	~~100~~%
i.	1936 Price range	$~~4500-60,000~~	~~90-*~~ ~~48~~ %	$~~5000-11,000~~	~~70-~~ ~~62~~ %	$Almost all dis-	%
j.	37-38 Price range	$~~4500-60,000~~	~~90-~~ ~~48~~ %	$~~5000-11,000~~	~~70-~~ ~~62~~ %	$tressed apartment	%
k.	Sales demand	$~~Under $7000~~		$~~Under $8000~~		$property owned by	
l.	Activity	~~Slow~~		~~Slow~~		bondholders.	
m.	1929 Rent range	$~~35 - 250~~	~~100~~%	$~~40 - 90~~	~~100~~%	$~~65 - 250~~	~~100~~%
n.	1936 Rent range	$~~30 - 150~~	~~86-~~ ~~60~~ %	$~~30 - 70~~	~~75-~~ ~~77~~ %	$	%
o.	37-38 Rent range	$~~30 - 150~~	~~86-~~ ~~60~~ %	$~~30 - 70~~	~~75-~~ ~~77~~ %	$~~50 - 200~~	~~—~~ %
p.	Rental demand	$~~Under $50~~		$~~Under $50~~		$	
q.	Activity	~~Good~~		~~Good~~			

4. AVAILABILITY OF MORTGAGE FUNDS: a. Home purchase ~~Limited~~; b. Home building ~~Limited~~
   * No homes in this category for sale.
5. CLARIFYING REMARKS: Prospect Ave. in this area was Milwaukee's "Gold Coast" 40 and 50 years ago. The large mansions on this and nearby streets are developing into club rooms, better class rooming houses, and semi-apartments. There are many large apartments in the area located chiefly between North Ave. and Woodstock Pl.; among them some of the best apartments in the city, virtually owned and managed by bondholders. West of Oakland Ave. and south of Riverside Park are a poor grade of houses. In the eastern part of the area, with a good lake view, many of the old and substantial houses are occupied by the original owners. Trend in this area is to demolish old houses and replace by apartments. Riverside and Gordon Parks and Lake Michigan are decidedly favorable influences. The entire area is spotty, homes ranging from modest prices up to $60,000, many of the latter class costing about $200,000.
6. NAME AND LOCATION ~~MILWAUKEE, WIS.~~ SECURITY GRADE ~~C~~ AREA NO. ~~9~~

Figure 5.3. Area Description sheet for Milwaukee's C9 neighborhood. Source: Nelson et al. (2022).



FORM 8
10-1-37

AREA DESCRIPTION - SECURITY MAP OF Atlanta, Georgia.

1. AREA CHARACTERISTICS:
   a. Description of Terrain. Level to rolling.

   b. Favorable Influences. Proximity to high-class residential section, Buckhead business center, schools, churches, and street car transportation. Restricted. Low effective tax rate.

   c. Detrimental Influences. Proximity to small negro settlement and expansion of Buckhead business center. Jerry-building in area.

   d. Percentage of land improved 60 %; e. Trend of desirability next 10-15 yrs. Static, with slightly downward trend.

2. INHABITANTS: Executive, business and professional and clerical workers
   a. Occupation ; b. Estimated annual family income $ 2.5 to 7.5
   c. Foreign-born families 0 %; None predominating; d. Negro None ; 0 %
   e. Infiltration of None ; f. Relief families None
   g. Population is increasing very slowly

3. BUILDINGS:

	PREDOMINATING 80 %		OTHER TYPE 20 %		OTHER TYPE %	
a. Type	1 sty singles		2 sty singles			
b. Construction	Br. Veneer		Br. Veneer			
c. Average Age	10 Years		1 - 10 Years		Years	
d. Repair	Good		Good			
e. Occupancy	99 %		100 %		%	
f. Home ownership	100 %		100 %		%	
g. Constructed past yr.	None		1 (12 M)			
h. 1929 Price range	$ 7 - 8 M	100%	$ 13.5 - 19 M	100%	$	100%
i. 1936 Price range	$ 5.5 - 6.5 M	80 %	$ 9.5 - 12.5 M	68%	$	%
j. 1938 Price range	$ 5.5 - 6.5 M	80 %	$ 9.5 - 12.5	68%	$	%
k. Sales demand	$ Poor		$ Fair		$	
l. Activity	None		Poor			
m. 1929 Rent range	$ No rentals	100%	$ No rentals	100%	$	100%
n. 1936 Rent range	$ " "	%	$ " "	%	$	%
o. 1938 Rent range	$ " "	%	$ " "	%	$	%
p. Rental demand	$ " "		$ " "		$	
q. Activity	" "		" "			

4. AVAILABILITY OF MORTGAGE FUNDS: a. Home purchase Limited ; b. Home building Limited

5. CLARIFYING REMARKS: This area contains mixture of one and two-story residences(majority built about 10 yrs ago), while present new construction in area is of speculative two-story type. Little possibility that this area will witness much higher values; hence, property if acquired in this area, should be sold. Southern portion of this area is rear portion of estates fronting on Peachtree Road.

6. NAME AND LOCATION Paces Ferry Road Development Company's property (outside city) SECURITY GRADE B AREA NO. 1

Figure 5.4. Area Description sheet for Atlanta's B1 neighborhood. Source: Nelson et al. (2022).

included proper zoning ordinances promoting land-use and class homogeneity, racially restrictive covenants and racial steering practices enforcing racial homogeneity, and cutting-edge appraisal methods rooted in ostensibly scientific principles (see Gotham, 2002; Stuart, 2003; Hornstein, 2005; Freund, 2007; Rothstein, 2017; Trounstine, 2018; Glotzer, 2020).

The second and third developments are closely related to the first. The second was a recent innovation in the appraisal field, which—as outlined in Chapter Two—held that an individual property's value was largely contingent on the characteristics of surrounding properties (see also Abrams, 1955; Weiss, 1989; Stuart, 2003; Hillier, 2005b; Lands, 2009; Winling and Michney, 2021). Among other factors, this included the RTV. The HOLC risk maps, with their color-coded neighborhood grades, provided information on the neighborhood-level factors believed to influence individual home values, including their current and anticipated racial characteristics (Hillier, 2005; Winling and Michney, 2021; Michney, 2022).

This attention to race in home appraisals, Abrams (1955) noted, grew in the early twentieth-century largely in response to the Great Migration, wherein many white and European immigrant neighborhoods in northern cities became predominantly Black. As discussed in Chapter Two, NAREB, FHA, HOLC, numerous property developers, appraisal textbooks, real estate brokers, and prominent academics advocated racial housing segregation to maintain home values in white neighborhoods (see Helper, 1969; Jackson, 1985, p. 198; Gotham, 2002; Freund, 2007; Winling and Michney, 2021). Developed in the 1910s and fully theorized by the 1930s, the RTV was arguably at the

height of its influence within the real estate blob when the City Survey program kicked off.

Third and finally, the emerging standard of the long-term home loan in the S&L business—which the HOLC was itself instrumental in establishing (Jackson, 1985; Immergluck, 2009)—elevated the need for a method to project future property value change. Thanks to HOLC's refinancing program and the FHA's mortgage insurance program, the typical life of a home mortgage loan in the US was extended from less than ten years to twenty and later thirty years (Immergluck, 2009). Though making homeownership more affordable, this presented a challenge for lenders and property owners alike because no one could know for certain what the future held for a given area. Since property values were understood to be linked to neighborhood attributes, the construction of a nearby landfill or industrial site fifteen years down the line could undermine one's investment. The widespread implementation of zoning helped assuage this particular concern, but racial "infiltration" or "encroachment"—as it was often referred to—remained a perceived threat.

This growing need to predict longer-term value trajectories further fueled the real estate industry's preoccupation with neighborhood trends, especially racial trends. In the mid-1950s, Rose Helper (1969, p. 33) documented how many Chicago-area "real estate men" would "make it their business to anticipate" the racial trend or "help to turn it in a certain direction." The HOLC security maps and notes also emphasize trends. An oft-overlooked feature of these maps is just how much temporal information they contain. Even the early neighborhood categories, "Still Desirable" and "Definitely Declining," suggest a dynamic understanding of neighborhoods. Moreover, the Description sheets—I

find in Milwaukee and Atlanta—often include detailed accounts of an area's past and projected future to give readers an idea not just about the current state of the neighborhood but what one could expect it to look like in the near term. The RTV, I argue in Chapter Two, was a transformative innovation for real estate capital because it allowed its agents to monitor, forecast, and partially control the temporal geographies of (anti-)value. But for this to work at a citywide scale—and to be in line with the tenets of appraisal science—it would require neighborhood-level data. The City Survey program was thus largely about gathering and assessing the data needed to put the RTV into action. It is an early example of spatial data science being put into practice.

Much of the appeal of data science to industry generally stems from its purported ability to inform and improve prediction and future action. The HOLC map grades could therefore be thought of, in a major sense, as predictive. They did not rank neighborhoods from best to worst as much as place them on a rough, anticipated time table spanning from profitable new construction (A) to effective obsolescence (D). Further, by including notes documenting what had been transpiring on the ground, they offer an assessment of what had gone well in places and what had gone poorly. The maps' effect, if not intent, was then to provide potential readers at the FHLBB with a quick way to assess what the returns on property ownership—*i.e.*, the trajectory of property values—in a given area was expected to look like in the near future (see also Nelson, 2021). Reflecting the value they were designed to capture, HOLC map grades and their accompanying notes were therefore spatial *and* temporal configurations. To assess how HOLC field agents understood and enacted the relationships between race and (anti-)value in their appraisals, then, I need a methodological approach suited for this multi-dimensionality. I propose

combining two that focus on space and time, respectively: critical cartography and narrative analysis.

Critical Narrative Cartography

Critical cartography is broadly interested in examining the social power embedded in and wielded by maps (Harley, 1989; Crampton and Krygier, 2006). Critical cartographers approach maps not as neutral representations of space but as partial, situated, and power-laden propositions about how one should view and interact with a given space (Wood, 1992; Cope and Elwood, 2009). They hold that maps themselves have a power to shape the material world they are purported to merely represent. And despite some internal disagreements, they generally maintain that the decisions that go into making maps reflect the whims, desires, and agendas of a mapmaker who is embedded within a particular social and political-economic system at a given moment (*ibid*.; see also Crampton, 2010). Considering the mapmakers' positionality, intended audience, intended goals, institutional ties, and historical-geographical context—as well as the those of the map-reader (Del Casino and Hanna, 2006; Kitchin and Dodge, 2007)—is thus important for deriving meaning from any map. These features provide crucial hints into why certain cartographic decisions were made—*e.g.*, whose interests does it serve to represent space in one way versus another? And they lend insights into how a given map may have been deployed.

Applying a critical cartographic framework to the City Survey program, Aalbers (2014) argues that the HOLC maps helped produce a particular housing geography that served the interests of real estate capital. Building on Jackson (1980), he suggests that the maps helped produce the racially uneven landscape of value they predicted. The fact that

the maps were drawn primarily by white men with backgrounds in banking, insurance, finance, and real estate, who were then working for a federal agency established to support the home lending industry, factors heavily into this analysis. And so does the fact that Aalbers' interest in HOLC maps was to draw historical parallels with contemporary neoliberal urban policies. But his account is complicated by the revelation that the maps did not actually inform private lending decisions, at least not directly (Hillier, 2003a, 2005a; Michney, 2022). Still, critical cartography is helpful here because it grants us a framework for seeing what is *reflected in* the maps. Specifically, it offers us a window into how the private-public real estate nexus at the time saw value in space and translated that perception into the map form. However, the maps alone can only say so much about the RTV. To paint a more complete picture, I need to assess the field notes, which requires more than critical cartography alone.

Narrative analysis—or "narrative inquiry" as some prefer (Clandinin and Connelly, 2000)—offers a framework for studying the experiences and events written through the narratives expressed in the HOLC maps and field notes (Franzosi, 1998; Chase, 2005; Elliott, 2005). "Narratives," as understood by narrative analysts, are a form of discourse "with a clear sequential order that connect[s] events in a meaningful way for a definite audience" (Hinchman and Hinchman, 1997 quoted in Elliott 2005, p. 3). They are hence "intrinsically temporal" (Gotham and Staples, 1996, p. 484). Narrative analysts thus pay special attention to both the order in which events unfold in a narrative and the social context in which the narratives were uttered (or written) and listened to (or read)—*e.g.*, who is telling the narrative; why they are telling it; for whom are they telling it; what is being said; what is being omitted; and so on. Highlighting these questions is crucial for

narrative analysts because narrative is understood as "retrospective meaning making" (Chase, 2005, p. 656). In this way, narrative analysis shares many commonalities with critical cartography.

As narrative analysts argue, narratives order how people interpret, communicate, and derive meaning from their experiences (Souto-Manning, 2014). Like critical cartography, then, studying narratives can assist social researchers connect microevents to macroprocesses (Gotham and Staples, 1996; Souto-Manning, 2014). By reading how HOLC field agents narrated the stories of the neighborhoods they appraised, we can link these individual narratives about places to (1) the broader discursive context of the time and place which shaped consequential policy decisions and investment strategies and (2) the wider political-economic context of New Deal-era racial capitalism. Moreover, approaching HOLC maps and notes as narratives can uncover a host of invaluable information about the appraisal process, such as how HOLC-commissioned appraisers perceived the entwined temporal geographies of race and (anti-)value.

Bringing critical cartography and narrative analysis together therefore offers considerable potential. Indeed, this has been recognized by numerous researchers, who have combined these approaches to study both the spatial qualities of narratives and the narrative qualities of maps (*e.g.*, Kwan, 2002; Kwan and Ding, 2008; Caquard, 2013; Caquard and Cartwright, 2014; Minde, 2015; Ryan, Foote and Azaryahu, 2016; Cromley, 2017; Mai *et al.*, 2022). A critical narrative cartography, I argue, is precisely what is needed for an engagement with HOLC mapping materials because the appraisers themselves—as agents of HOLC, FHLBB, and often the private home lending or selling business—viewed and treated urban space narratively and narrated their accounts

spatially. That is, they understood urban residential space as effectively having a beginning (initial construction), middle (concomitant processes of economic decline and racial transition, or racialized devaluation), and end (obsolescence), and they saw one neighborhood's story as intricately connected to others.

Procedurally, a narrative cartographic approach can take many forms (Kwan and Ding, 2008; see Caquard, 2013; Caquard and Cartwright, 2014). Some narrative researchers insist that narrative inquiry is "a form of living" (Clandinin and Connelly, 2000, p. 89) more than a set of methodological procedures, while others prefer a more systematic approach (see Labov, 1972). Narrative cartographers, for their part, have exhibited a similar methodological fluidity (*e.g.*, Kwan, 2002; Staley, 2007; Kwan and Ding, 2008; Boschmann and Cubbon, 2014; Minde, 2015; Cromley, 2017). I stake out a middle ground of sorts. I am less interested in breaking down and classifying the narrative structure of the maps and field notes than in inductively exploring how appraisers in two different cities narrated the interconnections between race, space, time, and value. Following scholars who have combined narrative analysis with other qualitative methodologies (Smith, 2000; Morgan-Fleming, Riegle and Fryer, 2007; Souto-Manning, 2014)—including critical cartographic approaches (*e.g.*, Minde, 2015; Cromley, 2017)—I chart my procedures as follows:

(1) Position the HOLC and the City Survey program within their sociohistorical context, and situate myself as author within this project.
(2) Identify two cities in which to perform the critical narrative cartography and situate them within their relevant contexts.

(3) Examine those two maps and note the features germane for my inquiry, including but not limited to the general shapes, borders, and arrangements of the neighborhood grades; neighborhood proximity to industrial, commercial, park, and other land uses; and other ancillary information provided (*e.g.*, whether grades are classified as "sparsely built up" or not).

(4) Link neighborhood grades to their respective Area Description sheets (see **Figures 5.3** and **5.4**), and sketch the general narratives that the appraiser is communicating about the space—*e.g.*, string together the "trend of desirability," "foreign-born," "Negro," "infiltration," historical price trend data, and any "clarifying remarks" with a focus on how (and where) this narrative information is located on the map. Additionally, highlight any intra-grade variability specified by the appraiser and any notable differences between the two cities.

(5) Record the overriding themes linking appraisals between cities as well as any noteworthy idiosyncrasies. In doing so, make note of the word choice, keeping an eye on where appraisers positioned themselves in this process and how they situated their descriptions of space in time.

(6) Revisit and reformulate the methods and inquiry as necessary.

As these procedures suggest, my critical narrative cartography has already started. Sections Two and Three of this chapter outlined the historical context of HOLC and the City Survey program, highlighting what is known about the motives of the project, structure of the agency, design of the field surveys, and intended audience. These

details—and how I conveyed them—all shape our perceptions of what the HOLC appraisers were mapping and why. I have also positioned this inquiry within a dissertation that seeks to illuminate how the RTV was put into action. That context in addition to my own positionality as a 30-something white male geography graduate student living in Athens, Georgia, USA in late 2022—as well as your own positionality as the reader—equally influences the interpretation. The meanings in these maps and notes are fluid, context-dependent, and rely on the reader as much as they do the author. A crucial part of critical narrative cartography is acknowledging that interplay and considering what it entails for the analysis.

Study Area

I focus my investigation on two places: Milwaukee, Wisconsin and Atlanta, Georgia. I choose two cities because my analysis in Chapter Four and Michney's (2022) account each suggest that there is some considerable regional variation in how HOLC assessed neighborhoods. Capturing these differences is crucial for assessing the RTV because its meaning, character, and potency assuredly vary from place to place. The vast regional, economic, and demographic differences between Milwaukee and Atlanta, in fact, are a major reason why I zoom into these two cities. Including more cities in the analysis could offer some beneficial breadth, but that would come at the expense of depth. And as I describe in this section, these two offer unique contrasts worth examining.

Several factors went into my decision to focus on Milwaukee and Atlanta in particular. The first three were technical. First, both cities have comprehensive HOLC records available through the DSL website (Nelson *et al.*, 2022), and their Area

Description sheet data has been cleaned and tabulated (see Chapter Four). In other words, they have the required materials for this analysis. Second, both of these cities had census tract data in 1940. The presence of this data allows me to cross-check some of the Area Description sheet information with a reliable, neighborhood-level source if warranted. Only about fifty cities in the US have both 1940 census tract data and comprehensive HOLC Area Description sheet data. Finally, I wanted some parity in the number of HOLC neighborhoods between cities. As I have explained, many of HOLC's mapping decisions remain mysterious. Some cities have hundreds of neighborhoods, while others—even of similar population size—have mere dozens. Atlanta and Milwaukee have 111 and 112, respectively, giving me a comparable neighborhood sample. Additionally, they were conducted at close to the same time—both in 1938—and used the same Area Description sheet format. This latter point is pertinent because HOLC had four different sheet formats, and they did not all include the same information (see Chapter Four).

My next set of criteria pertain to the characteristics of Milwaukee and Atlanta specifically. To capture regional differences in the RTV, each city should be in a different part of the country. Focusing on cities in the Upper Midwest and South present some interesting contrasts. For one, the South was governed by Jim Crow at the time of the City Survey program, giving it a special legal context that directly pertained to the RTV. The South's system of state-sanctioned racial separation was even lauded by prominent RTV proponent and eventual FHA official Frederick Babcock (1932, p. 91) as a model for the rest of the country to control what he described as the detrimental impacts of neighborhood-level racial diversity on property values. Atlanta, like the rest of the South, was under Jim Crow rule. And though not directly applying to *private*-sector housing,

this racist legal order substantially influenced the real estate industry's conceptions of residential space there. How the city government racially designated public housing, parks, schools, and pools informed lenders and brokers who the surrounding area was for. Changing a school from white-only to Black-only, for example, signaled that the area's occupants were set to fully transition (Kruse, 2005). Moreover, by the mid-1930s, Atlanta's city leaders were using racially segregated, federally funded public housing construction to enforce racial boundary lines (Keating and Flores, 2000; Rodriguez, 2021).

Relatedly, the South and Upper Midwest have distinct racial histories in terms of population movement. Rural-to-urban migration in northern cities is most often discussed as part of the First and Second Great Migrations during the early and mid-twentieth century, respectively. In Milwaukee, Black in-migration came in much larger numbers during the latter, well after the City Survey program (Rose, 1971; Trotter Jr., 1985). In fact, Milwaukee's Black population comprised only about 1.5 percent of its total population when the HOLC maps were drawn (Trotter Jr., 1985). Only three of Milwaukee County's 112 HOLC neighborhoods has any Black population listed, and only D5, just north of downtown, is listed as having a Black majority. Southern cities had an entirely different racial housing landscape. A full one-third of Atlanta's 1930s population was Black, which represented a proportional decline from its previous peak of 45 percent in 1870 (Bayor, 1996). About one-in-five of the Atlanta area's HOLC neighborhoods had some Black residents listed, and nineteen were reportedly majority Black (Chapter Four).

As a consequence of these alternative racial histories and regimes, the character of each city's local racial housing markets varied considerably. In Milwaukee, the sole Black district—which was among the oldest areas in the city (Trotter Jr., 1985)—was formerly home to Germans, Jewish immigrants, and other European ethnic groups. As in most other northern cities at the time, Black neighborhood formation here was largely a process of passing aging homes from white and European immigrant families to Black families. White real estate brokers and contract sellers frequently acted as intermediaries, and discriminatory housing practices essentially designated other areas of the city off-limits to newly arriving Black residents (see Helper, 1969; Hirsch, 1983; Sugrue, 1996). In Atlanta, white-to-Black neighborhood transition existed too, as did housing discrimination. But it existed alongside expansive new-build communities that were constructed specifically for Black occupants, by Black property developers, and through Black brokers (Wiese, 2004; Hankins and Holloway, 2020). As I highlight below, these vastly different racial contexts meaningfully shaped how HOLC field agents perceived the temporal geographies of race and value in these two places.

Another important distinction between the two regions was the prevalence of European immigrants. Atlanta has only one HOLC neighborhood (D12) with any "foreign-born" population, and it is listed at only 10 percent. Milwaukee, on the other hand, had among the highest shares of foreign-born and second-generation residents in the United States at the turn of the twentieth century, on par with New York City (Jones, 2009). It is still regarded as the "German Athens of America," and by the time the HOLC maps were drawn, Milwaukee had become home to thousands of other immigrants from Poland, Russia, Italy, Yugoslavia, Greece, and other countries across Eastern Europe.

This difference too would have substantially impacted neighborhood-grade assignment and the RTV's practical implications. As Jones (2009, p. 15) argues, "the primary lines of tension and division in Milwaukee revolved around ethnicity, religion, and class, not race" well into the twentieth century, with Germans claiming the top of the social and political hierarchy among first- and second-generation immigrants.

For all their differences, Milwaukee and Atlanta are also intimately connected. The move of the Milwaukee Braves Major League Baseball team to Atlanta in the mid-1960s signified the co-evolving statuses of the two cities within the US urban economy. In the 1930s, Milwaukee had double the population of Atlanta, with an economic base that was deeply tied up in heavy industry. By the 1960s, however, Milwaukee was experiencing population decline, while the Atlanta region was turning into one of the fastest growing metropolitan areas in the country. Since then, the persistence of racial segregation and inequality have stood out in both cities. By the 2010s, Metro Milwaukee had the highest level of Black-white residential segregation among major metropolitan areas (Frey, 2015). Furthermore, among these places, Metro Milwaukee has the lowest adjusted wages for Black households, highest rate of Black-white income inequality, highest Black poverty rate, and highest Black male incarceration rate (Levine, 2020). Though referred to as "Black Mecca" to signal its substantial Black wealth and cultural influence (Hobson, 2017; Hankins and Holloway, 2020; Allums, Markley and Hafley, 2022), Atlanta has the highest level of income inequality of major cities, largely driven by its significant white-Black earnings gap (Berube, 2018).

Underscoring these comparisons is especially germane for studying HOLC maps and the RTV. HOLC studies have disproportionately focused on cities in the north that

share many similarities with Milwaukee—large European immigrant population, relatively small and recent but growing Black population, industrial economic base, and so on. This regional bias has undoubtedly shaped how HOLC maps—and the RTV—have been discussed, leading researchers to miss many of the crucial factors distinguishing how housing markets operated across regions. In this sense, Milwaukee acts as a type of baseline in this study. It stands in for the kind of city usually discussed in the literature, whereas Atlanta presents a vastly different context, a place where an expansive Black middle and upper class had built considerable institutional power—albeit as junior partners—within the city's political-economic regime by mid-twentieth century (Stone, 1989). However, Milwaukee is also unique among northern cities in that its low pre-war Black population relative to its immigrant population were comparatively extreme.

The Maps Themselves

At a basic level, HOLC neighborhood grades represent residential sub/urban development as perceived by the surveyors. In the maps for both Milwaukee and Atlanta, most areas falling outside the periphery of the colorful grades are indicated in white, described in the legend as "Undeveloped or Farmland (No probable change within 5 years)." These areas mainly include streets, some physical features, and other landmarks, but they also contain areas that appear to be residential subdivisions. Like most HOLC cities, Milwaukee's Undeveloped areas are left comparatively blank. However, Atlanta's—quite uniquely—include property boundaries with their owners' names printed in front. Perusing these names offers some indication of who the large local landholders were at the time, with many being namesakes of prominent roads, parks, and

towns that exist today—*e.g.*, Candler, Collier, and Scott. One sizeable property on the north end of town is even listed as owned by the Knights of the Ku Klux Klan.

Though easy to dismiss, these areas provide some key clues about how HOLC appraisers understood the temporal geography of real estate. For one, despite being left virtually blank and labeled "Undeveloped," these areas did, in fact, contain residents. Referring to 1940 census tract data—which was collected only two years after the maps in these cities were drawn—we can see that people clearly lived there (see the first panel of **Figures 5.5** and **5.6**). And according to these maps, these areas were not necessarily less densely settled than some areas that received grades. Additionally, these areas did not fall cleanly outside administrative city boundaries, which are notably absent from both cities' maps. Still, these areas were beyond consideration because—as their label suggests—residential development was not anticipated. Yet, as **Figures 6.5** and **6.6** suggest, these areas would become the postwar suburbs within a few decades. Investing in the properties outside the graded portions would therefore have been quite lucrative, but the mapmakers consider these spaces outside of the calculation.

Suburban development was anticipated in other parts of the map. In both cities, areas marked with backslashes are called "Sparsely Built Up," and they fall within the graded regions. In Atlanta's map—like those of most other HOLC cities—portions of a handful of neighborhoods on the urban periphery are backslashed. Most of the notes for these areas do not mention the areas being sparsely developed, simply denoting them via the map symbology. However, for all the partially backslashed A- and B-graded neighborhoods in the Buckhead area on the northern edge of the map, the appraiser mentions how new the housing is. For A4, they mention lots ready for construction,

houses currently under construction, and "[c]onsiderable speculative building activity." New residential building was happening in these areas, but we are left with little information about what was happening in the Sparsely Built Up portions of C and D neighborhoods, save for C19, which is discussed below.

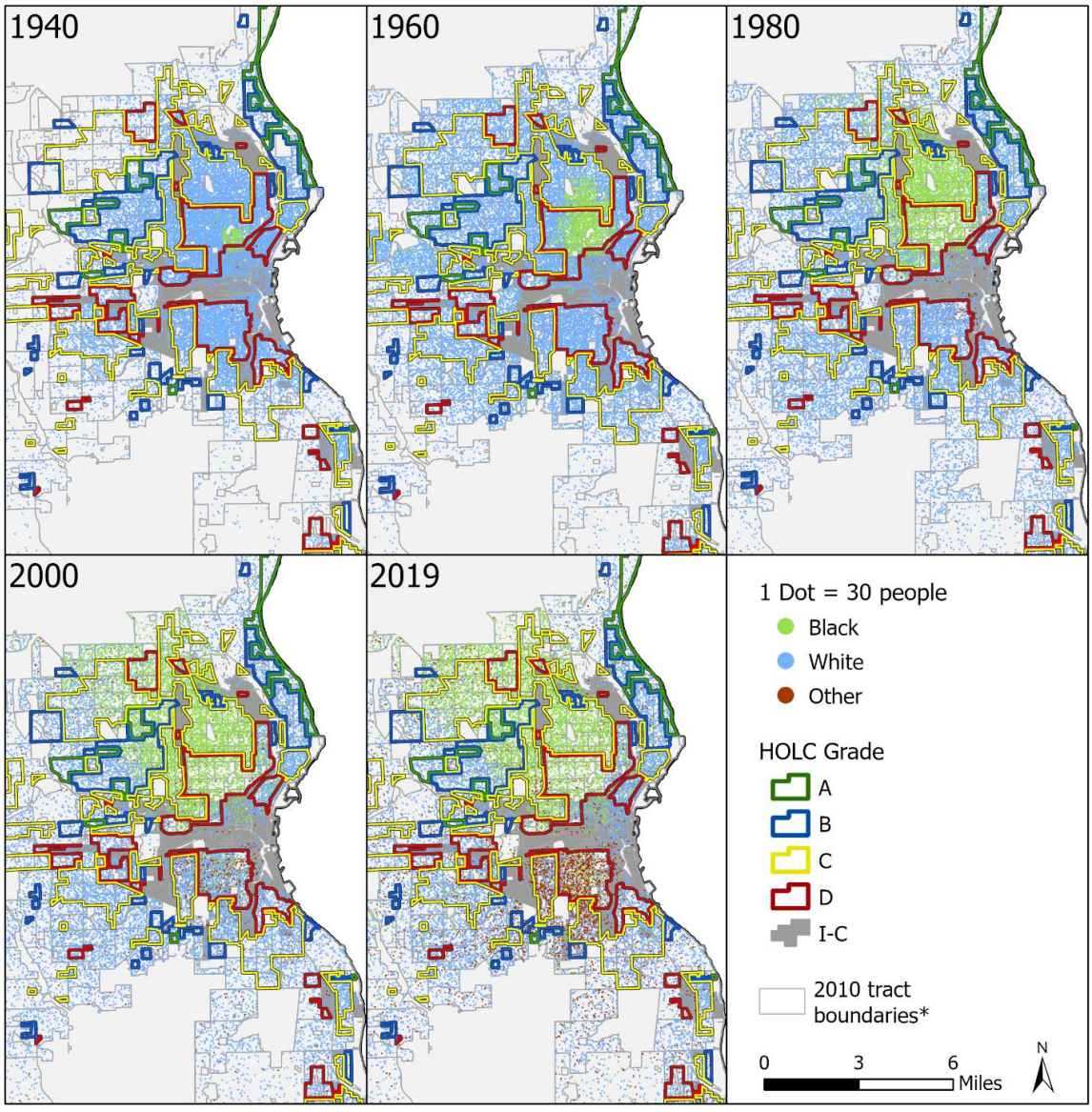


Figure 5.5. HOLC grades overlaying racial population distribution in Milwaukee, 1940 – 2019. The methods for generating the historical population estimates are discussed in Chapter Six. The I-C areas include the Industrial and Commercial districts, while the 2010 tract boundaries remove known uninhabited areas like parks, airports, cemeteries, railyards, golf courses, and the like.*

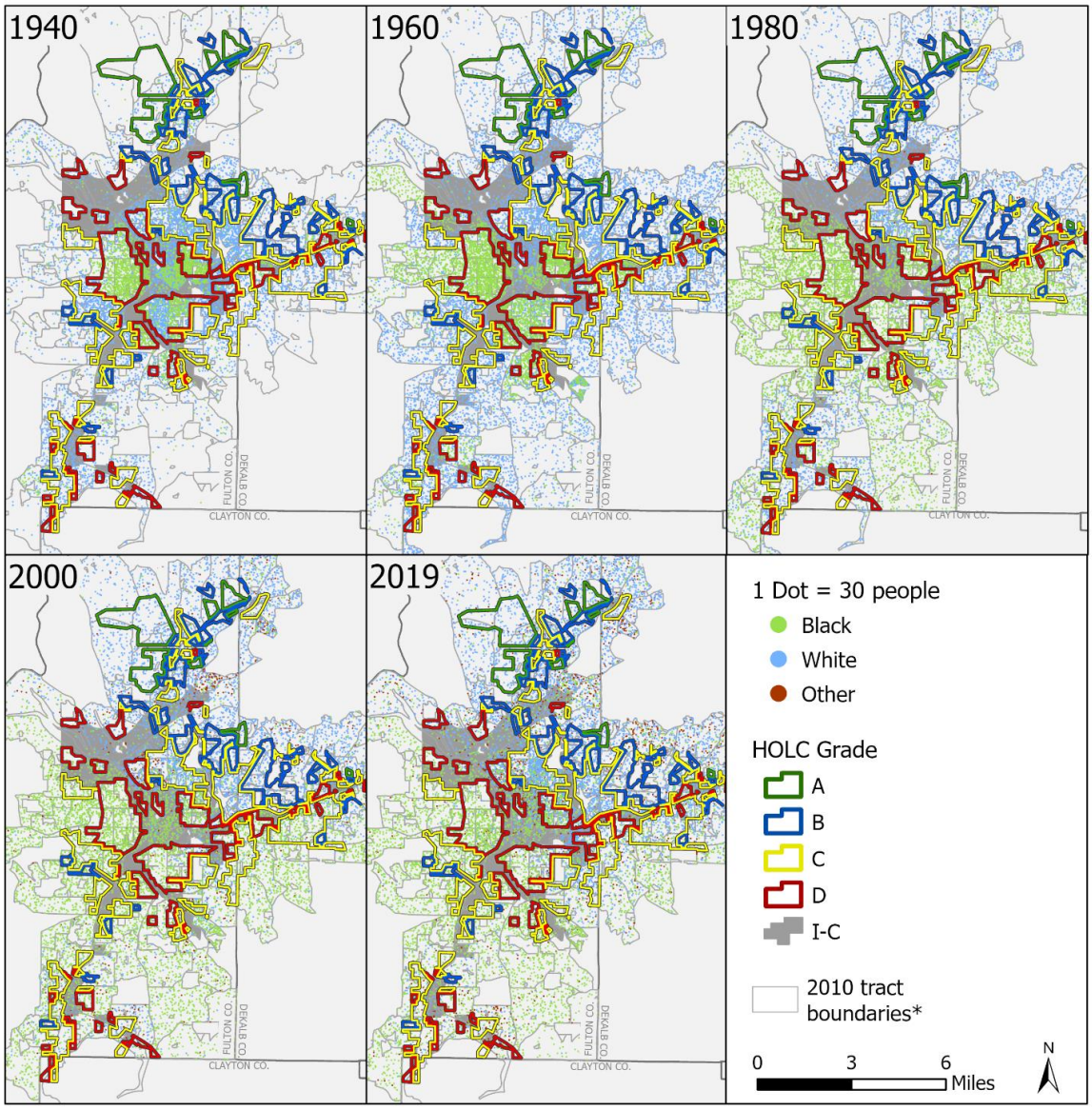


Figure 5.6. HOLC grades overlaying racial population distribution in Atlanta, 1940 – 2019. The methods for generating the historical population estimates are discussed in Chapter Six. The I-C areas include the Industrial and Commercial districts, while the 2010 tract boundaries remove known uninhabited areas like parks, airports, cemeteries, railyards, golf courses, and the like.*

Milwaukee's mappers went further than those of other cities. They created two separate sets of neighborhood grades—one for established neighborhoods (A, B, C, D) and one for Sparsely Built Up neighborhoods (S-A, S-B, S-C, S-D). In most of the latter, the appraiser noted that future development was likely, but until that point, only few

homes had been built. In the case of many higher-graded neighborhoods, development had reportedly paused during the Great Depression but was expected to resume soon, possibly raising many of the S-B areas to "first grade" (e.g., S-B4, S-B5, S-B8). S-C grades—like C areas generally—were more of a grab bag. They ranged from places with a "future [that] will lie entirely in a cheaper type of house" (S-C1) to places where "the trend is downward" (S-C11) to places with "good possibilities" (S-C5). S-D areas, it seems, were generally semi-rural areas strewn with "shacks" (S-D2) and which had "no possibilities" (S-D4) from the perspective of HOLC appraisers.

In a similar fashion, the map legends for both cities indicate non-graded areas that were presumably for "Industrial" or "Commercial (Important Retail and Wholesale Areas)" use, marked with forward slashes and cross-hatches, respectively. The latter includes the central business district (CBD). Like the Undeveloped areas, these spaces have no accompanying field notes, but they did contain residents (again, see **Figures 6.5** and **6.6**). Howell (2015, p. 148) called these areas "no-lined," and he speculated that HOLC agents assumed the existing homes in these areas would soon be converted to non-residential uses, perhaps via demolition. This is a reasonable assumption because a prominent theory of the day—advocated by Babcock (1932) among many others—held that property owners could substantially increase their returns on older residential properties by converting them to commercial or industry uses. However, as Michney (2022) discovered, this does not appear to be the motivation in the case of HOLC maps. As he found, the decision to leave these spaces ungraded came from higher ups at the FHLBB—Corwin Fergus, in particular—fairly late in the process with little stated rationale. Like in many other instances, Michney (2022, p. 330) found "no evidence of

planning foresight" on this matter. Accordingly, maps for some cities—*e.g.*, Memphis, TN and Des Moines, IA—were produced before the order came down and thus include no specially designated commercial or industrial areas.

Despite not receiving a formal HOLC grade, these Commercial and Industrial spaces do provide useful information about how HOLC agents conceptualized value in space and time. This is evident in the Area Description sheets of neighborhood C1 in Atlanta. Surrounding a commercial strip along Peachtree Road in Atlanta's not-yet-incorporated Buckhead district, the field agent initially recommended selling property in the area if acquired. However, they scratched out this suggestion and added an important caveat that resonates with Babcock's remarks about increasing returns by converting residential properties:

> From home-ownership standpoint, property, if acquired in this area, should be sold; however, in cases where zoning and restrictions permit, it might be better to hold for higher values occasioned by use of property for business purposes.

The perceived audience here is unmistakable. Only real estate capital would find this information useful. In fact, nearly all of the Clarifying Remarks in Atlanta's Description sheets are directly addressed to would-be property owners, investors, and lenders. If field agents included no other information about a neighborhood, they offered their recommendation about whether acquired property should be held or sold. In more extreme cases, they suggest "selling as quickly as possible." Sometimes, they elaborated. Often, they did not. One insightful example of the former case can be found in D20, which borders Downtown to the northeast and encompasses the southern and western

portions of the Old Fourth Ward, including Martin Luther King Jr.'s childhood home. Differentiating between Atlanta's white and Black housing markets, the appraiser noted that the "Trend of desirability" over the next ten to fifteen years was "Down for whites. Static for negroes." They expounded: "Although this area is considered a good negro rental area from an investment standpoint, it also contains one of the city's worst slum areas." In other words, HOLC's grading criteria required assigning this area a D grade, but there is money to be made by renting to Black tenants here.[10] Notably, this style of discussing the white and Black property markets as if they were entirely distinct can be found throughout Atlanta's Description sheets, particularly those for the city's most racially diverse neighborhoods around Downtown. I discuss this more later.

The agents in Milwaukee were not as terse. Still, their Clarifying Remarks nearly always took the form of investment advice or insider information, frequently describing sections of HOLC neighborhoods rather than the whole neighborhood itself. For instance, in B2, north of the city limits, a "sparsely built up section between Fairmount and Kensington should see a definite upward trend due to the amount of building therein." In C21, in the "Town of Greenfield" bordering the southwestern edge of Milwaukee, things were a bit less certain.[11] It was "at present a poor third grade section" with "poor transportation and school facilities," "unpaved streets," "no water or sewers," and "no fire protection." It might not look like much, but don't count it out. The field agent had a

[10] It is worth referring back to **Figure 5.5** to see what became of D20. What few white residents this neighborhood had in 1940 were gone by 1960. By 1980, its population had dropped by 6,000 largely thanks to urban renewal, including the construction of the Downtown Connector and the I-20 Interchange. By 2019, the population was up about 4,000 since 1980, but now white residents outnumbered Black residents.

[11] The "Town of Greenfield" as it was listed in the Area Description sheets was incorporated into the City of Greenfield in 1957: https://www.ci.greenfield.wi.us/1029/History.

tip: “Indications are that all utilities will very soon be extended to the area and the trend will then be upward.” They had similar information about C34 in what was then the Town of Lake. Though “homes are of cheaper construction” in the portion “West of Howell Ave.,” the “area is directly in line of future growth south” while “new water mains are being installed and will be in operation by fall.” Buying property here now would be prudent. The trends are going in the right direction.

Other areas did not have such favorable odds. C36 in South Milwaukee was one. Despite having “some substantial houses” on a few blocks and no “Detrimental Influences” listed, the appraiser remarked that “the future is not any too encouraging.” This was because the “gradual withdrawal of the dying plant by the du Pont Company, which formerly employed nine hundred men, has hit South Milwaukee hard.” The context provided for D19 was even more specific and the outlook less promising. Encompassing the Hamlet of Saint Martins in southwestern Milwaukee County, this area was considered a “doomed community with little or no hope for the future.” The reason offered bordered on personal grievance. In this “retired farmers’ community,” the people were “not progressive.” The appraiser offered more detail, noting that D19 was “[o]riginally settled by three families – Gross, Mayer, and Jochem – who held the place back by refusing to sell any property.” In other words, invest elsewhere. The situation on the ground does not bode well for profitable development.

These few examples reveal the predictive character of the notes. The notes are, indeed, forward-looking documents that encourage readers to think not only about what the conditions on the ground indicate about that day’s home values but what they suggest about the next day’s values as well. If we read the maps and notes as components of a

nascent spatial data science program designed for the benefit of real estate capital, prediction would be their most basic purpose. If one could know for certain how much property values would go up or down in one area versus another, they could make a killing in property speculation. Guess wrong, however, and they stand to suffer massive losses. "Guessing wrong," in fact, is what many in the industry believed led to the Great Depression's housing crash (see Hornstein, 2005; Woods, 2012). The goal then was for HOLC's appraisers to provide the most data and context they could to anticipate the trend, not just in the neighborhood being appraised but for urban places generally. As I explain in the following section, this context cohered across two overlapping cartographic narratives of value.

Cartographic Narratives of Value

In South Milwaukee's C36 neighborhood mentioned above, the appraiser concluded that the future is not too encouraging due to the flight of a major employer, the du Pont Company. In this instance, they were using a current event to predict what would happen to values in the area. Their remarks were particular to C36, but within this specific account was a more general theory of real estate value: the closing of a major employer negatively affects nearby home values—*i.e.*, it produces devaluation. Thus, what is said in the field notes about value in one area actually applies to all. If a different employer shut its doors in a different area, we can assume that this would likewise hurt home values there. Conversely, if no employer has recently left an area, we have no reason to assume property values would be detrimentally impacted *ceteris paribus*. Therefore, we have with these notes a series of narratives that offer a window into how

HOLC's appraisers—working on behalf of real estate capital—understood and predicted value generally.

In the examples cited above, including C36, the prediction was stated outright. Water mains are being installed. Expect property values to go up. A factory is closing. Expect property values to go down. More often, though, predictions were conveyed less directly through a series of interdependent, overlapping, and sometimes contradictory cartographic narratives of value. This makes sense when conceptualizing this program as a spatial data science operation. For an appraiser to make a value prediction that was considered soundly rooted in science, they would only have past (observable) trends, present (observable) relationships, and a (usually implicit) theory of real estate values to work with. Thus, even if no prediction is stated, the neighborhood's description, grade, and relationship to other neighborhoods—expressed collectively as its cartographic narrative—imply a prediction. The challenge for me is to infer what that prediction was—and what theory of value was being deployed—when it was not plainly named.

To organize the process of reading these narratives, I identify two broad categories of cartographic narrative that stand out in the Area Description sheets. Both contain temporal and spatial qualities, but they emphasize them in different ways. I call the first of these "Temporal Narratives." In short, these narratives provide a sequential, linear account of how that neighborhood took its present form. Here, prediction was informed principally by temporality. Appraisers placed past and ongoing developments observed within a given neighborhood along a singular trajectory, generally limiting their attention to that space. Even still, as I demonstrate, the narratives of one neighborhood speak to those of the others. I call the second narrative type "Proximity Narratives." Here,

the emphasis is reversed. Proximity Narratives stress the spatial more than the temporal, pointing to the neighborhood's spatial proximity to developments outside its boundaries. If Temporal Narratives place a neighborhood on a temporal trajectory, Proximity Narratives place it on a spatial plane, where near events are expected to exert influence on values now and into the future. Collectively, these narrative types portray a conception of value that is highly contingent on space and time.

Temporal Narratives

The Temporal Narrative most often takes the form of cause-and-effect. A led to B, which portends future outcome C. Generally, these narratives were confined to the neighborhood being appraised, but interestingly, they were deployed in nearly opposite ways in Atlanta and Milwaukee. In Atlanta, Temporal Narratives were almost always used to provide context for newer A and B neighborhoods, with one notable exception. In their characteristically terse style, Atlanta's appraisers would typically discuss a neighborhood's recent past, describing what had transpired since the onset of the Great Depression. Their narrative was hence usually about how new construction activity had picked up after having stalled for several years, indicating positive signs for property owners. These predictions were more audacious than they may seem now. In all but two of the eight "A" neighborhoods with this type of Temporal Narrative, the Area Description sheets record no home sales prior to the onset of the Depression. In the two others—A1 and A2 in Buckhead—homes at the time of neighborhood appraisal (1938) were still selling at only a little over half of the price of what they were in 1929 according to their Description sheets.

The one exception to this simple narrative in Atlanta is worth highlighting. Breaking with their penchant for writing short, one-to-two sentence summaries, the field notes in the "Sparsely Built Up" C19 neighborhood—part of the Avondale Estates community in DeKalb County east of the city—offered a lurid description of the neighborhood's history. Depicting a place struck particularly hard by the Depression, the appraiser wrote:

> This subdivision was developed on an extensive scale prior to the depression, but has witnessed no new residential construction for the past 9 years. During the depression, the owner of the subdivision became financially involved and at public sale lots sold at 10 to 20% of original sales price and in many instances sold at less than cost of paving assessments against the lots. However, the $7.500 building restrictions are still in force, which has prevented the construction of cheaper type homes. While this area has witnessed drastic shrinkage of values and heavy foreclosures, it is a desirable residential area from many standpoints and it is believed that the subdivision's desirability and values will stabilize at about present levels.

In this Temporal Narrative, the appraiser indicated that while the situation looked rough on the ground—reflected in its C grade—there was a good chance for prices to rebound, or at least to stabilize. To make this argument, they employed a narrative that distinguished why the type of devaluation that had occurred there was different from the devaluation taking place in other C-graded areas. The land, location, homes, and people (who were white and who had white collar jobs) were not the cause of it. Rather, it was a

"financially involved" owner, a single irresponsible individual. With the owner out of the picture and with zoning or deed restrictions preventing the construction of cheaper homes still intact, good money could be made there despite its unfavorable grade. This high degree of narrative detail being the exception suggests that the other C areas without such a complete account are graded C for the more usual reasons that augur poorly for home values: proximity to noxious land uses, poorer residents, older housing, and the like. In C19, though, there were extenuating circumstances.

Atlanta's C19 provides one example of many—across both cities—of appraisers providing background information to contextualize the map grade. Not all C and D areas were recommended to be avoided. Several—especially C areas—appeared to be assigned their grade by default. They were "spotty" or "difficult to grade" (*e.g.*, Milwaukee C33, C35) or had some good areas and some bad areas and thus were given a C because they could not easily fit into the other three categories. Even many D areas had blocks or whole section that appraisers thought had redeeming qualities (*e.g.*, Milwaukee D4). In Atlanta's D17—labeled in the Description sheets as the "Best negro section in Atlanta"—the appraiser recommended property investment. Curiously, as **Figure 5.7** shows, an earlier version of the HOLC map assigned much of this area A, B, or C grades. However, it was revised to D in the final version. The exact reasons for this change are unclear, but it is possible that this directive came from the national office, who may have preferred a more standardized approach that assigned Black-majority areas D grades regardless of their socioeconomic status or opinions of the local office (see Michney, 2022). The point is that the map grades only tell us so much. The devil was really in the Description sheets' details.

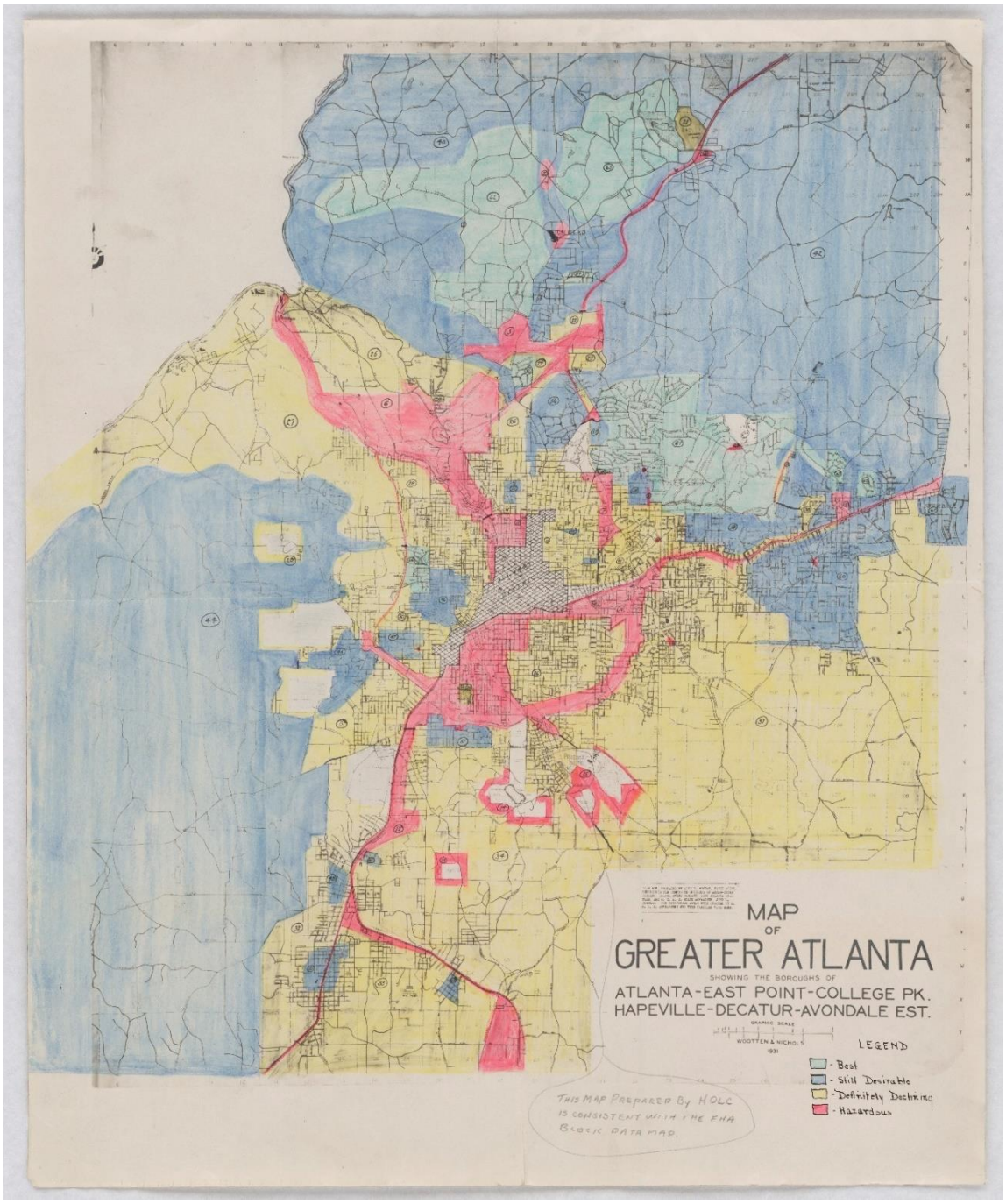


Figure 5.7. Draft version of Atlanta's HOLC map. The base map was produced in 1931, but it is unclear when the neighborhood grades were drawn. Source: National Archives. https://catalog.archives.gov/id/85713707.

In Milwaukee, Temporal Narratives sometimes echoed Atlanta's, with talk about whether or not building activity had resumed since the depths of the Depression,

particularly in the “Sparsely Built Up” neighborhoods (e.g., A3, A5, S-B4, S-B8, S-B9, S-C10). More often, however, Milwaukee’s Temporal Narratives operated in almost the opposite ways of Atlanta’s. That is, the level of detail provided in them was often much higher in the older C and D neighborhoods than in the A and B ones. The narratives here typically outlined the rise and presumptive fall of the neighborhood. In that respect, they performed two major functions. First, they served as a lesson about the fickleness of property values, a warning that even the most expensive neighborhoods with the largest estates and highest-class residents today may fall on hard times tomorrow. Second, these narratives often implied what the appraiser believed was the cause of the decline. These narrative functions are especially evident in the oldest areas surrounding Milwaukee’s Downtown and its industrial Menomonee Valley. Also highlighting the internal variability of HOLC’s neighborhood grades, the notes for C9 on the East Side are particularly instructive:

> Prospect Ave. in this area was Milwaukee's “Gold Coast” 40 and 50 years ago. The large mansions on this and nearby streets are developing into club rooms, better class rooming houses, and semi-apartments. There are many large apartments in the area located chiefly between North Ave. and Woodstock Pl.; among them some of the best apartments in the city, virtually owned and managed by bondholders. West of Oakland Ave. and south of Riverside Park are a poor grade of houses. In the eastern part of the area, with a good lake view, many of the old and substantial houses are occupied by the original owners. Trend in this area is to demolish old houses and replace by apartments.

Here, adjoining Lake Park, was a neighborhood that was once home to the wealthiest families in the city. However, even being a "Gold Coast" does not save a place from the inexorable march toward obsolescence. For the time being, there are still nice properties in some parts of the neighborhood with "original owners"—*i.e.*, higher class residents—but current trends suggest they will be gone soon. Little agency is ascribed here. It is not necessarily anyone's fault that apartment conversions and home demolitions are happening. It is part of the market process. This account has direct implications for how readers are to think of A1 to the north, which is named in the notes as part of the contemporary "gold coast." Could it one day share the fate of C9? Perhaps. But there are two crucial differences the appraiser assures. One, A1 is outside city limits and "therefore [has] the advantage of slightly lower tax rates." And two, unlike C9 in the past, "virtually all of [A1] is restricted as to price and type of structure." That is, exclusionary zoning measures, which were novel at the time, had been instituted.

In other Milwaukee neighborhoods, a "culprit of urban decline" (Smith, 1998, p. 3) was named. Jewish residents, in particular, were suggested to transmit devaluation. This can perhaps best be seen in a spatiotemporal saga unfolding across three in-town neighborhoods on Milwaukee's north side: D5, D6, and B9. According to the notes, D5 was the oldest, with homes ranging from 30 to 75 years, and B9 was the newest, with homes ranging from one to 40 years. Here is what was said about B9:

> This is a spotty area, but is a substantial neighborhood. There is a steady influx of Jews of a substantial class coming in from the yellow and red areas to the east, more especially along Center Street. Sherman Park to the north-east and Washington Park is to the southeast. The area is intersected

> with business streets and enjoys their adequate and quick transportation to downtown. The eastern portion and center of area are older sections.

The notes list the neighborhood as mostly American-born whites and Germans, but they warn of an "Infiltration of Jews," albeit "Jews of a substantial class." In isolation, this uncouth observation may seem odd or out of place. What was the purpose of mentioning this? When read alongside the notes from the other two neighborhoods, a more cohesive narrative starts to take shape. Here are the notes from D6, which was further east toward Downtown from B9 and which had homes ranging from ten to fifty years:

> 25 years ago this was a good, middle class section of Milwaukee occupied by the second generation of Germans. Jews began to move in 20 years ago. That portion south of Lisbon is the oldest part of the area. It is now a wage earners' area with the advantages of being close in. It has a number of small industrial plants along business streets. That portion north of North Avenue is slightly better than south of North Avenue, being not as old. The section west of 20th Street is better than that east of 20th. A good fourth grade area.

This paragraph provides more context for B9. Twenty-five years ago, D6 was a good neighborhood. Twenty years ago "Jews began to move in." Now, it is a D area, though a better-than-average one. The cause-and-effect is implied. If one was considering purchasing property in B9, they should be aware of what happened in D6 twenty years ago because that development—Jewish residents moving in—was currently happening in B9. Given this context, one might presume that B9 was destined for the same fate:

economic decline. But the story does not end here. D6 is only in transition. Map readers may also consider what has happened in D5, which abuts D6 to the east:

> This is the Negro and slum area of Milwaukee. It is old and very ragged. Besides the colored people, a large number of lower type Jews are moving into the section. This section housed Milwaukee's wealthiest families seventy years ago.

D5 is listed as 65 percent Black and 25 percent "Russian Jews." It is, from the appraiser's standpoint, at its end state: total obsolescence. As they note in the Description sheet's "Detrimental Influences" section, "condemnation proceedings [are] going on." Less context is provided here, but when read alongside B9 and D6, the reader can fill in the pieces. As upwardly mobile Jewish residents move to white German neighborhoods, the condition and appeal of the neighborhood to (white, non-Jewish) property owners went down, leading to later influxes of working-class Jewish residents and eventually Black residents. The insinuation is that Jewish in-migration—even of wealthier Jewish households—had served as a vehicle for eventual devaluation. It had guided an area's transition from housing the city's "wealthiest families" to its end state: "the Negro and slum area."[12] This sequence was not expressed in a single HOLC neighborhood but was conveyed across several.

If some people were believed to bring devaluation with them, then others, by definition, were believed to preserve value. This too is evident throughout the Temporal Narratives. In Milwaukee's C9 mentioned above, this was communicated through the

[12] A similar theme is present in Atlanta's notes. In Atlanta's A8—a top graded neighborhood—the appraiser listed the "influx of Jewish families" as a "detrimental influence." In both cities, Jewish presence itself was not necessarily a reason to reduce the letter grade, but it was something to note, to keep an eye on.

invocation of "original owners"—contrasted with newer renters—to denote the sustained quality of those houses. C8, just north of D6, offers an even more striking example. If its neighbor to the south had once been a primarily German neighborhood before "infiltration," then what is to say this largely German area wouldn't experience the same fate? The appraiser provided clarity on this point:

> This large area, while declining due to age, will sustain values for some time chiefly because of the conservative German influence.

Value and anti-value alike, it is clear from these notes, were believed to emanate from people. Though referencing the "conservative German influence" here, this sentiment was more often expressed through the language of class rather than nationality in the field notes, with the understanding that the residents being discussed were white. Well-off families did not just live in the neighborhoods with the highest property values because they could afford it. The values were high because well-off people lived there. The opposite, of course, was also assumed to be true as the examples from D5, D6, and B9 attest. Thus, the advantage of an area being "restricted"—as many A and B neighborhoods across both cities were—had as much to do with maintaining a type of resident as they did a type of structure. The two were seen as intertwined. As evident as this is throughout the Temporal Narratives, it is doubly so in the Proximity Narratives.

Proximity Narratives

In the Proximity Narratives, the perceived positive or negative influences on future property values were explained less in what had occurred in that neighborhood in the past than what is currently occurring nearby. The underlying assumption was that

things happening nearby will soon affect property values if they had not already. In other words, the emphasis was more spatial than temporal. There are many fairly innocuous examples of this narrative type. In Milwaukee's C9, for example, the appraiser mentioned that "Riverside and Gordon Parks and Lake Michigan are decidedly favorable influences," the assumption being that these amenities will help buoy property values above the level they would be otherwise. By contrast, proximity to industrial sites or cemeteries were typically listed as detrimental influences. These examples seem unremarkable at first blush. Of course proximity to these types of dis/amenities was a major factor in an area's valuation. What is notable is how smoothly these inoffensive dis/amenities were interchanged with descriptions of people. Milwaukee's B6, sandwiched between D3 and the Milwaukee River, offers a stark example:

> In the northern one-half of this area there are some very good new houses occupied by business and professional people. A city pumping station in the middle of the area is a detrimental influence. There is an infiltration of the better class of Polish. Houses fronting on Humboldt Avenue are older and hardly warrant a second grade rating. However, they constitute a good buffer to the better class of houses to the east.

Humboldt Avenue separates B6 from D3. This account hence suggests that the proximity of homes in B6 to a poorer D-graded area—occupied primarily by Polish families—would normally hurt its home values in ways similar to their proximity to a city pumping station. Their saving grace was a row of lower quality homes that served as a sacrificial barrier. The problem of proximity—*i.e.*, of anti-value infecting the area—was therefore disrupted, at least for the immediate future. Taken for granted in this narrative is that an

area's value trend will be impacted—negatively in this case—by the mere presence of certain nearby residents. Perhaps unsurprising today, this line of reasoning represented a major development in how property values were understood at the time (see Chapter Two).

In Milwaukee, Proximity Narratives frequently expressed concern about a place being close to "wage earners" or immigrants. Words like "infiltration" and "encroachment" were commonly employed to capture the danger. Curiously, though, this kind of Proximity Narrative was not applied to Black residents. In D5, the only Black-majority HOLC neighborhood in Milwaukee, the "infiltration" mentioned was of "Russian Jews." In D11 and S-D3, the only other two neighborhoods on the map with any Black residents mentioned, infiltration was of Polish and Italian immigrants. And in the neighborhoods surrounding D5, no field agent raised concern about being next to Milwaukee's largest Black-majority neighborhood. The appraisers, it appears, were not expecting Milwaukee's Black population to grow at all. Or rather, they did not think the spatial extent of the city's Black population would expand. Accordingly, Black presence was not treated as a conveyor of obsolescence as much as a symbol that obsolescence had already occurred.

In some ways, the Proximity Narratives in Atlanta operated similarly. There was good proximity and bad proximity, and each factored heavily into the grading process. In fact, the Atlanta appraisers almost always listed the neighborhood's location relative to industry, streetcar lines, schools, churches, parks, thoroughfares, and business districts in the Favorable or Detrimental Influences sections of the Area Description sheets. However, they were highly inconsistent about which nearby facilities were supposed to

be the former versus the latter. For instance, in D25, near the Howell Mill industrial area in the northwestern part of the city, the field agent included "Proximity to occupants' source of employment" as favorable, but then listed "Proximity to Seaboard [Railroad] shops and lines"—*i.e.*, residents' source of employment—as detrimental. This contradiction, the labeling of the same thing as both favorable and detrimental, indicates a base awareness of the inner-complexity of the notion of value. Appraisers knew, at some level, that a property's value depended on perspective. Yet, a major part of the motivation behind creating the City Survey program—indeed, a motivation of appraisal science generally—was to smooth over this complexity. The point was to establish a uniform value standard, which, by definition, could only represent one perspective: that of real estate capital.

In other ways, Atlanta's Proximity Narratives departed from Milwaukee's. Most noticeably, appraisers spoke much more of racial and class proximity rather than of current or anticipated immigrant infiltration. This, in some respects, is expected given the two cities' different racial/ethnic histories. But it is notable that Atlanta's appraisers almost never raised "infiltration" as a concern at all. The few exceptions include B14, where the appraiser mentioned the "infiltration of Jewish families," and C7 and D6, where they noted the infiltration of "lower income" groups. But other than that, "infiltration" goes by unmentioned. Rather, good and bad proximity to people was discussed in simpler terms. Being close to wealthy white people was favorable for home values, while being close to poor people or Black people was detrimental. The mechanism underlying this feature of real estate values was not explained. It was presented as self-evident.

The B1 neighborhood in Buckhead offers an illustrative example of this dynamic. It was favorably influenced by its "proximity to high-class residential section," along with the "Buckhead business section, schools, churches, and street car transportation." However, it was detrimentally influenced by its "proximity to small negro settlement and expansion of Buckhead business center." Again, being close to the business center was seen as simultaneously favorable and detrimental. But more importantly, the presumption here is that wealthier white residents embody and exude value, while poorer Black residents embody and exude "anti-value" (Harvey, 2017). Crucially, the latter concern does not stem from a fear of eventual infiltration, encroachment, or neighborhood racial transition. The majority Black D1 neighborhood being referenced was separated from B1 by C1 in addition to the Buckhead business center, and homes in D1—which primarily housed low-paid Black service and domestic workers in what was then known as Macedonia Park—sold for about one-tenth the price of homes in B1 according to the Description sheets.[13] Proximity itself—in the here and now—was the problem. Black presence was functionally treated as a disamenity that radiated anti-value.

Describing Black presence as detrimental in itself was typical throughout Atlanta's field notes (*e.g.*, B1, B22, C1, C18, C21, etc.). However, appraisers exhibited an ironic degree of inconsistency on this point. Being too close to the D1 was a Detrimental Influence for B1 and C1, but being *too far* from D1 was a Detrimental

[13] Macedonia Park emerged in the late 1800s as the Buckhead area's largest Black community. By the 1930s, it mainly housed Black service and domestic workers employed by Buckhead's white elite. The Fulton County government condemned the area in the 1940s reportedly due to sewage problems, forcing residents to relocate. The county government then razed most of the properties and built Bagley Park, which was designated for whites only when it opened in 1952, the same year Buckhead was annexed by Atlanta (Henry, 2016). Home prices for B1 and D1 are listed in their respective Area Description sheets. In the former, they range from $5,500 to $12,500. In the latter, they ranged from $800 to $1,250.

Influence for A1, A2, and A3. These high-end all-white Buckhead neighborhoods were commended in the field notes for their exclusivity. All were "restricted," and the first two had been "recently zoned for one-family residences." Yet, each shared a drawback. Their distance to D1 and the infrequent streetcar service in the region "present[ed] difficulty of transporting negro servants" (A1, A2). Black presence, in this regard, resembled industry when it came to HOLC's neighborhood valuation schema. For HOLC appraisers, having convenient access to Black domestic labor was simultaneously favorable and detrimental if that access was due to spatial proximity.

The inconsistency in Proximity Narratives is also evident when comparing notes from Atlanta's otherwise similar Black and white neighborhoods. In white neighborhoods like B1 and C1, proximity to a Black neighborhood was considered a negative influence. However, in a Black neighborhood like D15 on the city's south side, which adjoins the white C33, the presence of "Negro schools, churches, and community business centers" was listed as a favorable influence. If Black presence itself was considered detrimental, then how could a clustering of Black institutions be considered favorable?

The answer, it seems, is that appraisers understood the white and Black housing markets to exist completely apart from one another. Being in the vicinity of a Black neighborhood was seen as bad for white property values, but having stable community institutions—which were segregated by law—was seen as good for that community's internal prospects regardless of its racial composition because Black and white neighborhoods were understood to be, in some respects, discrete, self-contained entities. There could be some Black neighborhoods that were better than others from an investment standpoint just as it was with white neighborhoods. But in cases where the

two came into contact, the former could only exert a detrimental influence on the latter. This understanding of racial value is why Black presence was a sufficient but unnecessary reason to assign an area a D grade. However, as much as appraisers—working on behalf of real estate capital—may have thought of white and Black housing markets as distinct, they never could be. As Keeanga-Yamahtta Taylor (2019, p. 11) put it, there could be no "dual market" for housing because a "'white housing market' would [be] unintelligible without its Black counterpart." Rather, the value of white neighborhoods expressed in these notes was derived from them being not-Black. This was not some ancient law of real estate value as scholar-bureaucrats like Babcock (1932) and Hoyt (1933, 1939) would suggest, but was actively being imposed in these efforts to standardize the appraisal process.

Conclusion

HOLC's Residential Security maps have received an outsized amount of scholarly and media attention in recent years. Despite this, few studies have dug into the contents of their Area Description sheets, and none to my knowledge have conducted a systematic qualitative inquiry into the spatial narratives of value expressed in them. This oversight is regrettable because, as I have outlined, these maps and notes offer an unparalleled window into how real estate capital was coming to understand race and value as inextricable. Approaching the maps and notes not as documents designed to *do* redlining but as part of a nascent data science operation seeking to gather and assess housing data to better predict neighborhood-level values opens up new ways to engage with these invaluable mapping materials. For instance, it allowed me to uncover the Temporal and

Proximity Narratives that appraisers employed to communicate their expectations about anticipated value trajectories.

Both of these narrative types frequently discussed the racial characteristics of residents, but the accounts varied considerably between the two cities I studied. In Milwaukee, Temporal and Proximity Narratives often worked in tandem. They were commonly expressed through a joint, spatial and temporal fear of so-called "infiltration," particularly of Jewish residents and of first- and second-generation, non-German immigrants. Black presence in these narratives was cast not as a threat to white property values per se but as a sign that a residential area had reached its end state.

In Atlanta, by contrast, Temporal Narratives of race were virtually absent. Rather, the RTV was communicated primarily through Proximity Narratives, wherein Black residential presence was framed as an active detriment to white property values. In both cities, appraisers seem not to have anticipated Black residential expansion and mobility at all. Thus, by positioning Black presence as sign and source of obsolescence—but not yet as mobile threat—these accounts indicate a RTV in formation, one that rested on a confidence that Black movement was under control.

As expectations about Black mobility changed over the following decades—as Rose Helper's (1969) interviews with Chicago-area "real estate men" attest—these Temporal and Proximity Narratives of value were well positioned to incorporate the possibility of Black "infiltration." This update would not have been difficult because the narratives present in the Description sheets had already established Black residential presence as detrimental to white property values and as the manifestation of neighborhood obsolescence. Accordingly, the sheets indicate an extant economic

rationale for segregationist policy, white flight, and land abandonment ready to be fully deployed when Black urban population expansion would reach its peak after World War II. In this respect, the Description sheets offer a singular look into how the RTV was congealing on the eve of its most significant production: the concomitant over-investment in suburbs and under-investment in central cities.

CHAPTER 6

UNDERESTIMATING RACISM? DECOUPLING RACE AND "REDLINING"[14]

[14] Markley, Scott and Holloway, Steve. To be submitted to *Annals of the American Association of Geographers*.

Abstract

A rapidly expanding body of research has sought to connect the Home Owners' Loan Corporation's (HOLC) so-called "redlining" maps to a wide array of present-day social injustices. The assertion, in general, is that the drawing of the maps helped entrench emerging co-geographies of racial segregation and devaluation that have continued to reproduce racial-spatial inequities through time. Beyond resting on the unsubstantiated claim that the HOLC maps were used to inform lending decisions, such arguments have likely underestimated the historical power of racism by hyper-focusing on the map grades rather than on racial segregation itself. To investigate this possibility, I conduct a set of statistical analyses that decouple race from "redlining." In these analyses, I first find that postwar Black population growth did not occur in HOLC "redlined" areas generally but was most concentrated in those areas that had an initial Black population or that were adjacent to them. Second, I find that while HOLC grade was the stronger predictor of neighborhood home values until about 1970, Black population share has become the more salient factor since. Thus, rather than obliquely highlighting the persistent geographies of racialized devaluation by way of the HOLC map grades, researchers ought to instead focus their attention on the racially segregated geographies of value directly.

Introduction

Over the past decade, a torrent of new studies has sought to link the Home Owners' Loan Corporation's (HOLC) Residential Security maps to an endless array of present-day urban social inequities across the United States. Everything from residential segregation to tree canopy coverage to toxic waste sites to cancer prevalence, it seems,

can be traced to this New Deal-era federal mapping program. The precise arguments vary, but in general, the claim is that (1) since these maps employed racist assumptions about the geographies of risk and (2) since they presumably informed real estate capital where investments should and should not be steered, they helped produce the landscape of racialized devaluation they predicted. As evidence, studies frequently rely on statistical analyses that trace today's geographical manifestations of devaluation—in the form of depressed property values, pollution, adverse health outcomes, heat clusters, and the like—to the areas that were rated lowest by HOLC appraisers: those graded D, colored red, originally labeled "Hazardous," and now frequently described as "redlined."

Though contributors to this rapidly growing body of work aim to highlight the potent legacies of institutional racism, I argue that this hyper-focus on HOLC's "redlined" areas vastly *underestimates* racism's importance in shaping the sub/urban housing landscape. This underestimation, I claim, is the product of a co-related theoretical and methodological myopia. In the case of the former, contributors to this work—which falls under the rubric of Quantitative HOLC Culpablism (see Chapter Three)—see the HOLC maps as a sort of "smoking gun" (Hillier, 2003a, p. 413) that directly implicates the federal government. The maps, applying an overtly racist appraisal criteria, thus have a special allure because they can ostensibly tie present-day racial inequities to concrete policy. However, by fixating on the map grade boundaries, I maintain, scholars miss a much more salient source of lasting racial injustice that is reflected *in* the maps: the fact that race and value have been co-constituted in a way that conflates whiteness with value and Blackness with anti-value—*i.e.*, what Charles Abrams (1955) called the "racist theory of value" (RTV) (see Chapter Two). In this way, David

Imbroscio (2021) points out, racism is a much more pervasive force than these HOLC "redlining" analyses suggest. It is not merely an unremedied policy of the past but is—as Robinson's (2000 [1983]) notion of "racial capitalism" suggests—imbued in the very market structures that organize society.

This self-imposed theoretical constraint has led to a mutually reinforcing methodological narrowness. It is now well-established that Black residential presence was a *sufficient but not necessary* factor in determining HOLC neighborhood grades (see Chapter Three). A large portion of these spaces may have been assigned a D grade simply because Black people lived there, but an even larger portion had no Black residents at all. Thus, if we mapped present-day concentrations of poverty or pollution or health outcomes or whatever other contemporary sociospatial injustice onto the HOLC grade boundaries, we might then suspect results to vary significantly *within* D-graded boundaries. After all, if race and home values are co-constituted in the way scholars of racial capitalism have suggested (Freund, 2007; Bonds, 2019; Taylor, 2019; Markley *et al.*, 2020) and as the maps' Area Description sheets have indicated (see Chapter Five), we would expect Black residential presence to be a more salient predictor of home values than HOLC grade assignment. Studies showing that present-day devaluation is over-concentrated in HOLC "redlined" areas would then be masking this potentially stronger relationship and thus underestimating the ongoing power of the RTV in undermining Black wealth to prop up white wealth.

In this chapter, I investigate this possibility. Namely, I conduct a set of descriptive and inferential statistical analyses that disentangle race from HOLC grades to examine their independent effects on home values over time. To start, I use tabulated HOLC Area

Description sheet data (see Chapter Four) to demonstrate that Black population change over time has not occurred evenly across D-graded areas. I show that it has instead been most concentrated in those HOLC areas that already had Black residents or that were adjacent to them. In fact, once accounting for initial Black population share and first-order adjacency, the difference in future Black population growth between D- and C-graded neighborhoods nearly disappears.

The next set of analyses applies linear regressions to get at the race-value question more directly. This approach allows me to assess the added explanatory power of HOLC grade designations and Black population share separately on home values for each decade from 1940 until the 2015-2019 American Community Survey (ACS). This is conducted in two ways. The first way uses HOLC grade boundaries as the geographical unit of analysis, aligning it with much of the existing HOLC literature. The second way serves as a robustness check. It relies on 2010 vintage census tracts instead, using each tract's proportional overlap with the HOLC grades as the variable of interest. This second approach has the advantage of reducing one step of data interpolation for the census variables. Further, it allows me to go beyond the map grades so to speak, allowing me to include the HOLC maps' "no-lined" (Howell, 2015, p. 148) areas in the analysis.

Suggesting reliability of the findings, the results from the two approaches produce virtually identical results. They show that the added effect of a neighborhood's HOLC grade was stronger than its Black population share on home values until 1970. Then, from 1980 on, the opposite became true. By that point, Black residential presence and HOLC grade had largely been decoupled from another, and devaluation—approximated using median home values—moved with the former. In other words, racialized

devaluation has not been fixed in HOLC's D-graded areas over time. The RTV has rendered it mobile by attaching anti-value to Black households (see Chapter Two). Rather than highlighting racialized devaluation *by way of* the HOLC map grades, then, I propose that researchers focus their attention on the racially segregated geographies of value directly.

HOLC Redlining?

In the 1970s, the story goes, historian Kenneth Jackson came across HOLC's Residential Security maps in the National Archives. Captivated, he rifled through the vividly colored documents and their highly detailed Area Description sheets, discovering that the federal government had carried out a semi-secretive neighborhood surveying program forty years prior. As a part of this program, HOLC's surveyors assigned neighborhoods one of four grades ranging from A to D reflecting the purported risk their attributes posed to property owners. Reading through the Description sheets, Jackson found that the appraisers almost invariably assigned its lowest grades to areas where Black residents were living, often leaving candidly racist remarks that equated Black residential presence with risk. Writing his findings up first in a journal article (Jackson, 1980) and later in his landmark book, *Crabgrass Frontier*, Jackson (1985) speculated that the federal government may have played an instrumental role in legitimizing and spreading the practice of redlining. Further establishing what I have called the HOLC Culpable position (see Chapter Three), Jackson supposed that these maps were used by private mortgage lenders and the Federal Housing Administration (FHA) to guide their home lending decisions, informing them to avoid D-graded neighborhoods in favor of the higher-rated areas.

Jackson's account of the HOLC mapping program appeared throughout a series of widely read urban history books throughout the 1990s and 2000s. Most often, the maps were brought up in a paragraph or two—often along with the FHA—to highlight a concrete example of how the federal government helped shape the racially segregated postwar housing landscape (see Chapter Three). Beyond those mentions, the maps also appeared in a handful of archival studies seeking to build a more refined understanding of the City Survey program, some of which expressed skepticism that the HOLC maps were actually used to make lending decisions (e.g., Hillier, 2003a, 2005a; Crossney and Bartelt, 2005a, 2005b). Over this period, the HOLC maps were well-known among urban scholars, but research into their use and ramifications generally remained a niche interest among a subset of urban historians. That would change in the 2010s.

Three developments were particularly influential in the HOLC maps' elevation to the mainstream. The first was the publication of Ta-Nehisi Coates's (2014) article, *The Case for Reparations*, which was named the "Top Work of Journalism of the Last Decade" by New York University's Carter Journalism Institute (NYU, 2020) and which centered the HOLC maps in its narrative. The second was the publication of Richard Rothstein's (2017) similarly acclaimed book, *The Color of Law*, which prominently displays a HOLC map on its cover. And the third was the release of the *Mapping Inequality* project by the University of Richmond's Digital Scholarship Lab (DSL) in 2016 (Nelson *et al.*, 2022). While the first two helped spark general interest through their frequent appearance on a multitude of high-profile reading lists, the last one has does so by presenting the maps and their Area Description sheets in a user-friendly, interactive web interface that makes exploring their contents much easier. In addition, the DSL has

made the digitized and georeferenced HOLC grade boundaries available for download, inviting researchers to analyze how HOLC's neighborhood polygons map onto a wide array of present-day phenomena.

Even before DSL's digitized polygons were posted online, researchers were interested in overlaying the map grades onto later manifestations of urban inequity. Hernandez (2009), for example, linked HOLC "redlining" with subprime lending in the lead-up to the foreclosure crisis in Sacramento, California, while Huggins (2015) tied it to concentrations of tuberculosis reported in Austin, Texas during the early 1950s. These early single-city entries to the genre laid the groundwork for the larger-scale analyses that would come.

In one of the first large-scale, multi-city investigations, Appel and Nickerson (2016) more directly aligned their inquiry with the HOLC Culpable literature by putting Jackson's suggestion that the maps served as a self-fulfilling prophecy to the test. Treating HOLC's D-graded neighborhood boundaries as indicators of where historical mortgage redlining took place, they argued that the maps actively hardened home value segregation. That is, while they showed that the spatial distribution of home values varied smoothly at D-graded boundaries when the maps were drawn, they find that home values on the "redlined" side were nearly five percent lower than those on the other side by 1990. The central contention is that the maps cast a long shadow over the urban housing landscape.

The new availability of the georeferenced maps accelerated these types of analyses. Soon after their release, a study by the Chicago Federal Reserve made a parallel argument to Appel and Nickerson's using a wider selection of variables (Aaronson,

Hartley and Mazumder, 2017). Again focusing on areas around neighborhood boundaries, these authors found that the lower-graded side of a D-C boundary or C-B boundary had notable increases in its number of Black residents until 1970 and decreases in its homeownership rates, home values, and credit scores until the present day (see also Aaronson, Hartley and Mazumder, 2021). In a follow-up study focusing on numerous measures of economic opportunity and socioeconomic outcomes, the authors arrive at similar results. Here, they suggest that "growing up on the lower-graded side of a HOLC border had an economically large and statistically significant effect on the life chances of cohorts born several decades after the maps were drawn" (Aaronson *et al.*, 2021, p. 1). The assertion—like Appel and Nickerson's—is that the maps actively concentrated long-term racialized devaluation in their "redlined" spaces.

This line of argument has become the standard in HOLC research. Since these articles came out, scores of new Quantitative Culpable studies have sought to link the HOLC "redlining" grades to one or another contemporary spatial injustice. Everything from housing supply (Krimmel, 2017) to apartment concentrations (An, Orlando and Rodnyansky, 2019) to vacancy rates (Rutan and Glass, 2018) to urban tree canopy coverage and heat exposure (Hoffman, Shandas and Pendleton, 2020; Locke *et al.*, 2021) to industrial and environmental hazards (Grove *et al.*, 2018; Cushing *et al.*, 2022; Gonzalez *et al.*, 2022) to health outcomes (see Lee *et al.*, 2022; Swope, Hernández and Cushing, 2022 for recent reviews), it seems, can be attributed to HOLC's City Survey program. The specific causal mechanisms—when brought up at all—may vary, but the essential claim underlying this body of work is that the HOLC maps—via their presumed use by government agencies and/or private real estate firms—helped generate these

future pockets of racialized devaluation. Moreover, it is argued that since the HOLC grading criteria was facially racist, these connections demonstrate a lasting legacy of state-sanctioned racism in cities across the country.

There is an alluring simplicity to this argument. The federal government oversaw an explicitly racist program, and the impacts of that program are still affecting people today. Indeed, for this reason, topline results from these articles have been regularly covered in *The New York Times* (Badger, 2017; Popovich and Palmer, 2020; Zhong and Popovich, 2022), *The Washington Post* (Jan, 2018), *NPR* (Anderson, 2020; Godoy, 2020), and numerous other major news outlets. Accordingly, the notion that the maps produced the racialized devaluation they predicted is now practically taken for granted in most mainstream narratives about racism in the US. Yet, as a number of skeptics have pointed out, these sorts of HOLC Culpable arguments rest on two contingencies. First, they assume that the grading criteria was, in fact, racist. And second, they assume that the maps were used in some capacity to make lending decisions.

The first contingency has been challenged by scholars employing statistical analyses purporting to show that racial composition was not as important of a factor in determining HOLC grades as variables like housing age and condition and socioeconomic status (*e.g.*, Hillier, 2005a; Greer, 2012; Fishback *et al.*, 2020). However, these studies are unconvincing. As I pointed out in Chapter Three, they fail to capture how Black presence was a sufficient but unnecessary factor for assigning a place a D grade. A casual look at most Black-majority neighborhood's Area Description sheets reveals that racial composition was an extremely important factor in how that neighborhood was graded (see also Winling and Michney, 2021). That Black-majority D-

graded areas and non-Black D-graded areas both correlated closely with income, home value, and perceived building quality is beside the point. Black presence is quite literally listed as a "Detrimental Influence" in many places (see Chapter Five). In fact, that Black population share was a distinct entry on the description sheets at all indicates something about its importance for grade determination. This critique of HOLC Culpablism thus misses the mark.

The second contingency is more serious. Studies linking HOLC "redlining" to present-day injustices have assumed, at some level, that the maps were actually referenced by state or private institutions to inform their lending decisions. Despite the confusion in some accounts, we know HOLC did not use the maps for their lending program because it had ended before the maps were drawn (see Michney and Winling, 2020). There has not been convincing evidence indicating that the maps were widely distributed either. To the contrary, existing records show that HOLC and its parent agency—the Federal Home Loan Bank Board (FHLBB)—were highly protective of the maps. Internal correspondence does indicate that HOLC shared the maps with the FHA (Hillier, 2005a; Woods, 2012; Michney, 2022), but these were likely only for comparison purposes. The FHA created its own maps even before HOLC, and the two agencies' map grades only partially overlapped (Greer, 2014; Fishback *et al.*, 2021; Xu, 2021).

HOLC almost never shared their maps with private lenders (Hillier, 2003a; Michney, 2022). The agency did, however, contract with individual lending agents and real estate brokers to conduct the surveys to make the maps. Thus, it is probable that some local agents had at least seen them. As Hillier (2003a) notes, though, even if this was the case, this small handful of agents would have hardly been able to shape citywide

lending patterns on their own. More likely, lenders would have conducted their own data gathering operations—using more up-to-date census and administrative records and their local expertise—and produced their own redlining maps in house. Indeed, the FHLBB *did* distribute instructions to thousands of savings and loan institutions detailing how to effectively recreate the HOLC maps, and they adamantly promoted the use of maps generally to make better lending decisions (Woods, 2012). But they did not distribute the maps themselves. Still, in this way, the HOLC maps can be useful for envisioning how the federal government promoted redlining generally. Since they suggest an understanding of neighborhood value that is heavily contingent on racial composition, we may expect locally made maps—which would have actually been put into use—to mirror them fairly closely. Yet, as Fishback and colleagues (2021, p. 11) point out, there is a notable distinction "between the dissemination of mapmaking techniques versus the dissemination of the HOLC's maps themselves," and the latter has been the defining presumption of the Quantitative Culpable literature.

The question is: does this distinction matter? If the argument is simply that the HOLC maps implicate the federal government for endorsing and spreading the RTV and/or the practice of redlining, then the distinction between the *maps themselves* being distributed versus the *mapping techniques* being distributed does not make much of a difference. Both accounts suggest federal complicity. However, as I have documented, this has not been the primary claim of the Quantitative Culpable scholarship. That argument—or at least, its implication—has been that the maps themselves helped *cause* future forms of devaluation in the places they depicted (see also Swope *et al*., 2022). There is more on the line with this contention. As I argue in the following section, this

claim is not only tenuous but also vastly *undersells* the persistent significance of the RTV.

What have Quantitative Culpable studies actually been finding?

If we concede that the maps were not directly used for redlining, we are left with an immediate problem. What have all these studies showing statistically significant relationships between HOLC "redlining" and present-day social inequities actually been finding? In many cases, the answer is fairly straightforward. At the time of HOLC's appraisal, areas that would be assigned a D grade—by definition—contained the oldest, most disinvested, and most non-white urban neighborhoods. Often, as well, they were adjacent to industrial or commercial districts (see Chapter Five). Thus, if these areas continue to be the most underserved, marginalized, polluted, and hottest today, it does not suggest that these conditions were entrenched by the HOLC maps per se but that they have been continually reproduced in these spaces over time. This itself is noteworthy and calls for further interrogation into the mechanisms by which racial capitalism has concentrated and confined racialized devaluation in certain areas. But it does not indicate that the HOLC grades are the cause. Indeed, hyper-focusing on the HOLC maps—and the HOLC maps alone—to explain the longevity of spatially concentrated racialized devaluation is precisely the problem I am addressing because it glosses over what else might be going on.

Much of the Quantitative Culpable literature thus suffers from a causality problem. Some scholars, recognizing this issue, have aimed to get around it in two main ways. A few in the health redlining literature have tried to do so by treating the HOLC grades not as literal examples of government redlining but as *proxies* for place-based

discriminatory policies (Jacoby *et al.*, 2018; Benns *et al.*, 2020; Huang and Sehgal, 2022; see Swope, Hernández and Cushing, 2022 for discussion). This subtle move acknowledges that the link between the HOLC maps and actual policy is tenuous, but the arguments these studies make remain functionally identical to those that do not. Thus, such acknowledgments have not really changed the research questions or methodologies but have merely rationalized them. Missing here is an explanation for why the HOLC grades should make a suitable proxy.

Other scholars have approached the causality problem more directly. Rather than eliding it, they have tried to confront it head on with modified difference-in-differences (DD) equations (e.g., Krimmel, 2017; Faber, 2020; Aaronson *et al.*, 2021; Aaronson, Hartley and Mazumder, 2021). DD models, when applied under a specific set of controlled circumstances, can enable causal inference. Accordingly, if researchers can isolate the effects of the map grades on particular outcomes—such as racial segregation, relative home value decline, and the like—they will have a basis to claim that the maps caused those outcomes. Krimmel (2017), Aaronson and colleagues (2021), and Aaronson, Hartley, and Mazumber (2017, 2021) purport to do this by assessing the maps' border effects on an array of racial, housing, and socioeconomic variables, whereas Faber (2020) examines the maps' supposed influence on Black-white segregation at the city level. Though quickly becoming canonical in the broader HOLC literature, none of their results can be considered conclusive upon close inspection.

For one, Faber's (2020) award-winning study suffers from a disqualifying categorization error. He differentiates cities that received HOLC maps from those that did not, then with his DD model, finds that Black-white housing segregation worsened

significantly more in the "graded" cities than the "ungraded" ones. However, his sample of "graded" cities is derived from the partial list of HOLC cities from Hillier (2005a) and DSL's *Mapping Inequality* project (Nelson *et al.*, 2022). Since his time of writing, *Mapping Inequality* has significantly expanded its cache of HOLC cities and has announced that more are on the way. Faber only provides a table listing his "graded" cities, but by my count, he is missing at least 64 cities that are currently up on the *Mapping Inequality* site, not to mention the ones that will be released in the future. Thus, he seems to have misclassified these cities as "ungraded" when they were actually graded, rendering his results useless.[15]

The border effects studies have other problems. The Aaronson, Hartley, and Mazumder (2017, 2021) studies, for example, conduct their DD models by assigning the lower-grade side of a B-C and C-D boundary as the "treated" side. They then claim to show that HOLC map grades worsened economic and racial segregation and economic opportunities in those "treated" areas. Krimmel (2017) makes an analogous argument with housing supply, suggesting that D-graded sides of boundaries have lower present-day housing supply than their C-graded counterfactuals. All claim the maps are what caused these outcomes. However, these DD model designs ignore the probability that the

[15] It is possible that some cities were left off his list of "graded" cities due to not meeting his criteria of containing at least two census tract centroids (a questionable cutoff for numerous reasons) and having at least 100 Black residents in a given study year. However, some cities—such as Elizabeth, NJ, which is one of the few "ungraded" cities mentions in the paper—did, in fact, receive a HOLC map. Several more would have certainly met his criteria but were not listed as "graded," including Birmingham, AL; Phoenix, AZ; Oakland, San Jose, and San Diego, CA; Denver, CO; Miami and St. Petersburg, FL; Dallas and Houston, TX; Portland, OR; Richmond, VA; Seattle, WA; and many others. Reviewing Faber's list of graded cities, it seems likely that larger cities in the Midwest—*i.e.*, those known to have the highest postwar Black-white dissimilarity index scores—were overrepresented in his erroneously defined graded group since they were the most likely to be present in the earlier *Mapping Inequality* list, potentially accounting for the discrepancy he finds.

HOLC surveyors drew the D-grade boundaries where they knew private lenders were already systematically denying loans. After all, the HOLC appraisal sheets include information about existing mortgage availability, and as I show in Chapter Four, mortgages were much more likely to already be restricted and homes were much more likely to be considered in poor condition in D-graded areas than C-graded ones. These analyses are thus likely showing the persistent effect of private lending discrimination *reflected in* the maps rather than the effect of the maps themselves.

There are other issues as well. DD results can only be considered valid if the treated and control groups experienced parallel pre-trends. That is, if the D side of the C-D boundary is experiencing faster relative home value depreciation than the C side before the HOLC maps were made, then higher rates of post-map home value depreciation on the D side cannot be said to come from the map itself since that trend was already present. Krimmel does not address this at all. Aaronson, Hartley, and Mazumbder claim to take care of it by establishing a set of counterfactual areas that experienced similar pre-trends to their "treated" group. They define the pre-trends by looking at data from 1910 to 1930. However, this approach does not account for trends occurring between 1930 and the time the maps were drawn—1937 to 1940. This poses a major issue because, as we know, a lot changed between 1930 and 1937. For one, the housing market collapsed. For another, the entire federal administrative state—including its housing functions—experienced their most dramatic overhaul to date. In that time, the HOLC was created, and its mortgage refinancing program had run its entire course. HOLC's Area Description sheets even plainly request data on post-1929 and post-1935 home value and rental trends, population change, "infiltration," and "trend of desirability" (see Chapter

Five), indicating that *recent* trends in those attributes were important for determining neighborhood grades. Therefore, again, these DD models fail to establish causality.[16] This, of course, should not be surprising given that we know the maps were almost certainly part of an internal data gathering operation and were thus not actually used to do redlining (see Chapter Five).

Despite its shortcomings, the Quantitative Culpable scholarship has been on the right track in at least one key way. HOLC's mapping program, I have stated, was undeniably racist. The logic underpinning its creation internalized the RTV and put it into action. In that sense, the maps and their notes *reflect* this logic and thus offer an illuminating window into how real estate capital viewed and reinforced this race-value relation in urban space (see Chapters Three and Five). Clearly recognizing this potential, scholars in the Quantitative Culpable camp have leveraged these maps in service of a broader argument: that racist policies and practices have produced a persistent geography of uneven racial value. However, if the motivating purpose of these analyses is to build this larger argument, then focusing exclusively on the map grades is *underselling* it.

There are at least two ways this is the case. As I described in the introduction to this chapter, this underestimation stems from a mutually reinforcing theoretical and methodological narrowness. Theoretically, the hyper-attention steered toward the HOLC

[16] The data interpolation methods for these studies are also highly suspect. Aaronson and colleagues assign weighted tract-level values to small eighth- and quarter-mile strips around HOLC boundaries for years 1950–1980, while Krimmel uses tract centroids. Since these findings are contingent on what happens within these tiny sub-tract boundary areas, these fast-and-loose interpolation procedures are hardly sufficient. It is likelier that the D-sided areas on C-D boundaries overlap tracts that fall principally within larger D graded neighborhoods and vice versa, confounding the estimates. Appel and Nickerson (2016) mitigate this issue by using only 1940 and 1990 block-level values, but their analysis does not allow for any sort of causal inference.

grades to the exclusion of other factors positions racism's potency as an unremedied government policy of the past, when racism in actuality—Racial Capitalism tells us—is imbued in the notion of value itself (Bonds 2019; Imbroscio 2021; Robinson 1983; see also Chapter Two). In this way, focusing on the historical (re)production of racialized devaluation *by way of* the HOLC map grades—which, again, were not directly used for redlining—is needlessly circuitous. If we can agree that racist policies like redlining, racial steering, blockbusting, racially restrictive covenants, and discriminatory appraisals helped produce today's racially segregated housing landscape, then why not focus more directly on the present-day devaluation concentrated *in* Black-plurality and majority neighborhoods rather than in D-graded neighborhoods?

This theoretical narrowness has been supported by a related lack of methodological imagination. Quantitative Culpable studies, I have outlined, remain fixated on the present-day injustices in D-graded neighborhoods. With this self-imposed tunnel vision, nearly all find the associations they are looking for (see Swope *et al.*, 2022). But what if these findings are the result of a lurking variable problem? Since there is a close association between HOLC "redlined" areas and Black population share in most cities, it is likely that the apparent effect of HOLC grades on later outcomes—like home values, for example—is masking a stronger effect between Black population share and those outcomes. Perhaps, then, it is not the HOLC grade boundaries themselves that led to later devaluation but the RTV reflected in them. Thus, if we updated the analysis by centering the RTV itself rather the HOLC mapping program, we would expect home values to correlate more strongly with Black population percentage over time than HOLC grade. The remainder of this chapter is dedicated to this task.

Study Area

Before proceeding with the analysis, I first select the cities to study. To be included, a city must meet four criteria. First, there must be a HOLC map available for that city through the DSL website. Second, the HOLC map must come with a complete set of field notes, allowing for an analysis of their Area Description sheet data. In some cities—*e.g.*, Denver—a few but not all HOLC neighborhoods are missing their Area Description sheets. In these cases, I still include the city but remove those particular neighborhoods in the analyses that require Description sheet data. Third, there must have been census tracts available in that city's county in 1940. Since the spatiotemporal data interpolation procedure I conduct produces more reliable estimates in places where tracts were historically present, this step helps ensure the data quality (see Appendices A and B). Finally, to address further data quality concerns, I exclude cities that had 1940 tract data but are missing 1950 and 1960 data due to lost or destroyed historical records (see Ruggles *et al.*, 2011). This pertains only to a handful of cities, most of which are in New Jersey—including Atlantic City and several in the Greater New York-Newark region.

To analyze the historical changes in racial and home value data in relation to HOLC neighborhood grades, I need all variables in a consistent geometry. Most HOLC researchers prefer to work with the HOLC grade boundaries themselves. For my analysis of racial change in different HOLC grade types and for my first cut at assessing home values, I do as well. However, I see no compelling reason to stick with those polygons. There is limited information about how these map boundaries were drawn, but we know the criteria used was highly inconsistent between places (Michney, 2022). Further, we know that HOLC map grade boundaries rarely conformed to recognized neighborhood areas, and appraisers left no indication about the size of a neighborhood's population.

Census tracts provide a much more consistent geometry with well-recognized criteria. Nested within counties, tracts have an average of about 4,000 people residing within their boundaries (US Census Bureau, 2018). Additionally, they are commonly used to approximate neighborhoods in social, demographic, and housing research, and—perhaps most importantly—they contain the census data needed for this study. Therefore, I conduct my analysis of historical home value change in both HOLC neighborhood boundaries and in 2010 vintage census tracts. This provides me with two sets of results to compare, helping to ensure the robustness of the findings.

To focus on the places where HOLC grades were drawn for the tract-level analysis, I include only the tracts that intersect either a HOLC grade or an Industrial/ Commercial area depicted on the HOLC maps. This provides me with a set of tracts that were functionally considered urban by HOLC surveyors at the time of the City Survey program or that were immediately adjacent to them. These latter areas—classified in **Table 6.1** as "Ungraded"—would, by and large, become the early postwar suburbs. But at the time of appraisal, they were considered "Undeveloped" or "Farmland," as most city's HOLC map legends indicate (see Chapter Five). Once identifying these tracts, I remove the ones with populations or housing unit counts under ten, and I take out those with missing or extremely low median home values (in the bottom 0.1 percent). This leaves me with 9,649 census tracts across 3,909 HOLC neighborhoods in 34 metropolitan areas (see **Table 6.1**).

Table 6.1. Study area broken down by metro area, HOLC neighborhoods, and census tracts.

Metros	***HOLC N'hoods (Tracts)***	***Metros***	***HOLC N'hoods (Tracts)***
Midwest (n = 11)	**1,635 (2,972)**	**Northeast (n = 11)**	**1,113 (4,162)**
Akron, OH	67 (100)	Baltimore, MD	57 (268)
Greater Chicago, IL-IN	629 (1,111)	Greater Boston, MA	39 (392)
Greater Cleveland, OH	190 (373)	Buffalo, NY	33 (111)
Dayton, OH	46 (79)	Greater Hartford, CT	27 (98)
Greater Detroit, MI	272 (584)	Greater New Haven, CT	47 (92)
Flint, MI	50 (57)	Greater New York, NY-NJ	533 (2,248)
Indianapolis, IN	73 (165)	Greater Philadelphia, PA-NJ	119 (460)
Kansas City, MO-KS	72 (105)	Pittsburgh, PA	114 (256)
Milwaukee, WI	111 (255)	Rochester, NY	60 (116)
East St. Louis, IL	47 (38)	Syracuse, NY	48 (76)
Toledo, OH	78 (105)	Trenton, NJ	36 (45)
South (n = 7)	**456 (613)**	**West (n = 5)**	**705 (1,902)**
Atlanta, GA	111 (132)	Denver, CO	39 (105)
Augusta, GA	25 (19)	Los Angeles, CA	412 (1,457)
Birmingham, AL	60 (84)	Portland, OR	90 (122)
Dallas, TX	46 (121)	Oakland, CA	118 (174)
Macon, GA	40 (23)	Tacoma, WA	46 (44)
New Orleans, LA	126 (164)		
Richmond, VA	48 (70)		
Totals: Metros = 39; Cities = 66; HOLC Neighborhoods = 3,909; Tracts = 10,981			

Working with different neighborhood geometries presents an additional issue requiring further data preparation. Since census tracts are designed to maintain a roughly consistent population through time, they are redrawn every decade. This means that the tract-level data from one census year is not compatible with tract-level data from another. Likewise, HOLC neighborhood boundaries do not cleanly overlay tracts. Yet, to analyze the relationship between home values, racial composition, and HOLC grades over time, I need data from each census vintage from 1940 to 2010 plus from the 2015-2019 American Community Survey (ACS). In particular, I need four population-based

variables: the population count, white population percentage, Black population percentage, and Other population percentage.[17] I need four housing-based variables: the housing unit count, occupancy rate, ownership rate, and single-family detached unit percentage. And I need three housing unit or household-based monetary variables: median home value, median contract rent, and median household income.

To harmonize these data across census vintages and to convert them into HOLC neighborhood boundaries, I conduct a series of data interpolation procedures. The detailed methodologies of these procedures are presented in Appendices A and B. Appendix A, which has been published with colleagues in *Scientific Data* (see Markley *et al.*, 2022), discusses the methods we developed to generate historical housing unit counts and urbanization estimates in consistent 2010 vintage tract boundaries. Appendix B then outlines how I leveraged those housing unit estimates to generate the rest of the variables used in the analyses.

Descriptive Analyses

A key claim permeating the Quantitative Culpable scholarship is that HOLC "redlined" areas carved out spaces that would contain growing Black populations in cities after World War II. Aaronson and colleagues (Aaronson, Hartley and Mazumder, 2017, 2021), in particular, emphasize this point. They report that in the decades following the City Survey program, Black populations grew in D areas more than C areas, C areas more than B areas, and so on. This apparent relationship between HOLC grades and

[17] Older census tract vintages only provide white, Black, and "Other" racial data, so I must work with these three categories.

future neighborhood racial composition could lead to some methodological complications in my efforts to disentangle the separate effects of Black residential presence and HOLC grade on home values. However, by focusing on the higher *average* growth of Black residents in D-graded areas, this narrative obscures as much as it illuminates. According to Aaronson and colleagues' numbers, the Black share of the population in D areas peaked at only 45.5 percent in 1980. Though high relative to most cities' overall Black populations, this number is far from suggesting that HOLC "redlining" consistently led to Black residential concentration. Rather, it is likely that Black populations increased substantially more in *some* D and C neighborhoods than others. The question is: which ones?

An analysis that starts with the four HOLC grade categories cannot tell us anything about this potential within-grade variability. In fact, treating the HOLC grades as static, uniform categories paints a highly misleading picture about the geographies of postwar Black urban settlement. It suggests that incoming Black households were steered, in some way or another, to areas HOLC appraisers rated lowest without regard to the location of the neighborhood. Yet, in the broader urban literature, it is well-known that the location of a given urban neighborhood was a highly relevant factor in this equation. For a combination of reasons—from housing discrimination to familial ties—Black residents who relocated to cities after World War II most often moved to areas where Black people were already living (Philpott, 1978; Hirsch, 1983; Trotter Jr., 1985; Self, 2003; Wilkerson, 2010; Gibbons, 2018; Hunter and Robinson, 2018). Then, as the numbers of Black in-migrants grew and as whites responded by moving to the suburbs, Black residents fanned outward—often in one or two directions—from those initial nodes

into surrounding neighborhoods (Rose, 1971; Hirsch, 1983; Sugrue, 1996). Knowing this would suggest that postwar urban Black population growth would not likely follow the HOLC grade lines as much as it would follow existing Black residential geographies. Indeed, this is plainly evident in the four maps shown in **Figures 6.1** through **6.4**, which overlay population change by race on HOLC boundaries for four cities across the US.

In all four cities shown here, postwar Black population growth stretched directionally with little regard to HOLC grade. In Milwaukee, it went north. In Atlanta, it went south and west. In Oakland, it went east. And in Baltimore, it spread into a "butterfly" pattern (Brown, 2021). Moreover, in both Milwaukee and Baltimore especially, the maps show D-graded areas on the south sides with little to no Black population in 1940 that never gained a substantial number of Black residents. Solely focusing on the apparent link between Black-majority neighborhoods and "redlined" areas clearly misses a big part of the story.

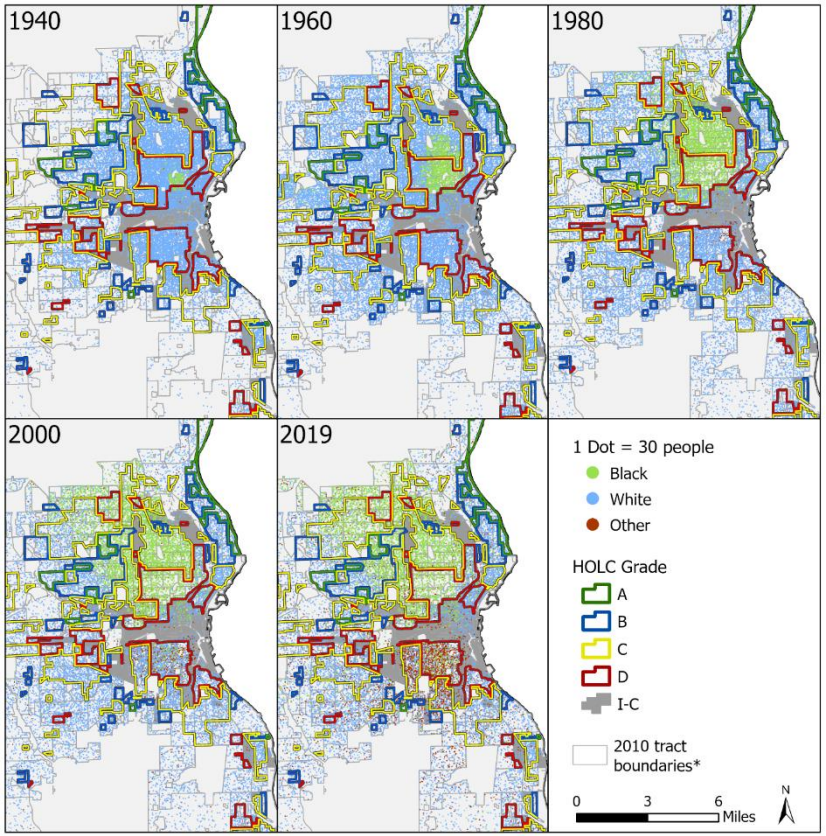


Figure 6.1. HOLC grades overlaying racial population distribution in Milwaukee, 1940 – 2019. The I-C areas include the Industrial and Commercial districts, while the 2010 tract boundaries remove known uninhabited areas like parks, airports, cemeteries, railyards, golf courses, and the like.*

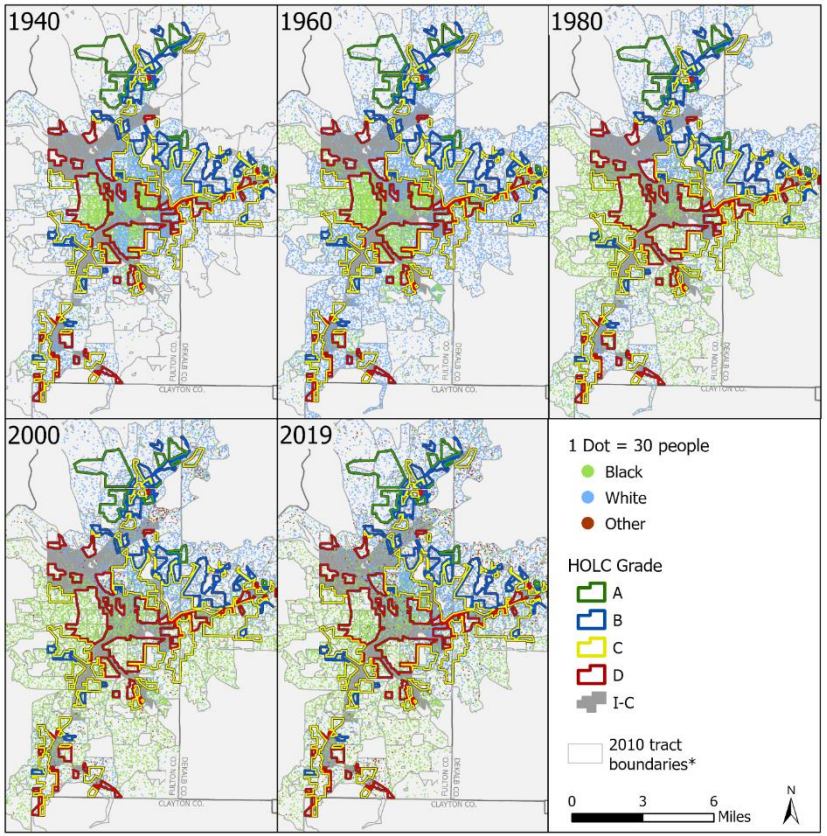


Figure 6.2. HOLC grades overlaying racial population distribution in Atlanta, 1940 – 2019. The I-C areas include the Industrial and Commercial districts, while the 2010 tract boundaries remove known uninhabited areas like parks, airports, cemeteries, railyards, golf courses, and the like.*

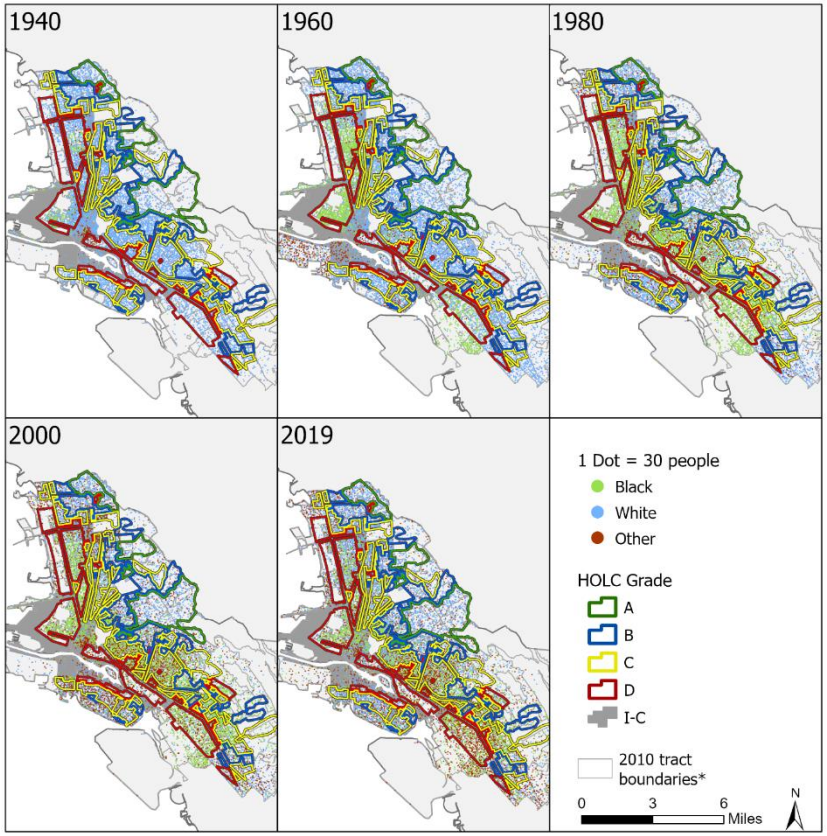


Figure 6.3. HOLC grades overlaying racial population distribution in Oakland, 1940 – 2019. The I-C areas include the Industrial and Commercial districts, while the 2010 tract boundaries remove known uninhabited areas like parks, airports, cemeteries, railyards, golf courses, and the like.*

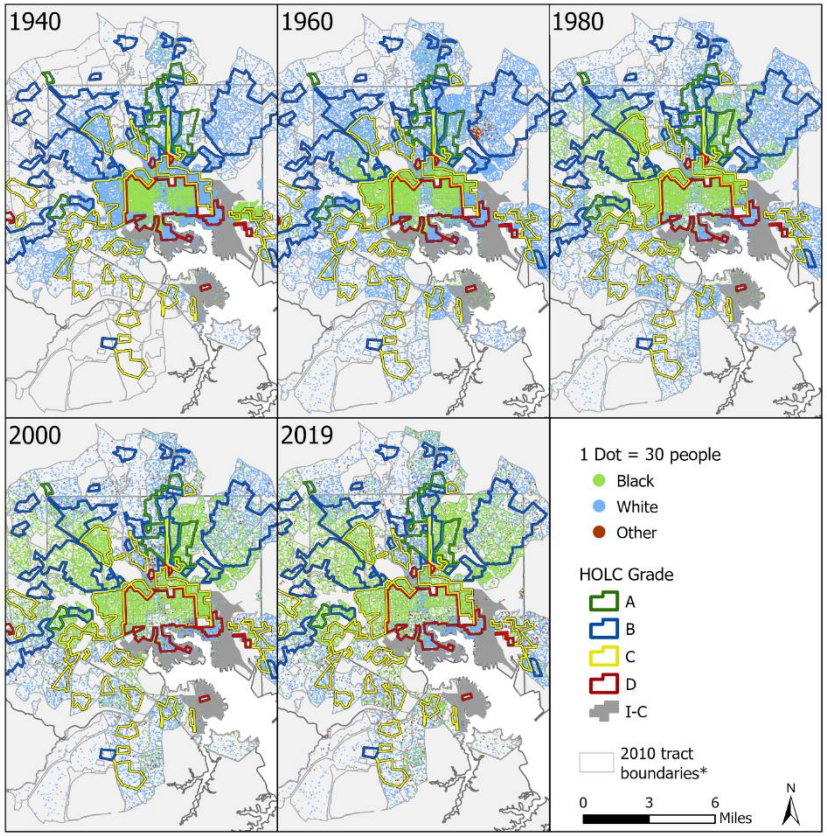


Figure 6.4. HOLC grades overlaying racial population distribution in Baltimore, 1940 – 2019. The I-C areas include the Industrial and Commercial districts, while the 2010 tract boundaries remove known uninhabited areas like parks, airports, cemeteries, railyards, golf courses, and the like.*

To further illustrate the divergent geographies of race and HOLC grade, I can break HOLC neighborhood areas down by the Black population share listed in their Area Description sheets (data prepared in Chapter Four). To do that, I divide HOLC neighborhoods into three categories. The first includes those with Black populations at or above 10 percent (*Black10*). The second includes those with Black populations under 10 percent but that share a boundary with the first group (*Neighbor*). And the final category includes the rest of the areas, grouped by grade (*Neither*). **Figure 6.5** displays the results, and **Table 6.2** below that shows the breakdown of grades by category. **Panel (a)** in **Figure 6.5** shows Black population percentage by HOLC grade over time. The methods used to interpolate this data are presented in Appendices A and B. This figure matches Aaronson, Hartley, and Mazumder's (2021) closely, with some differences arising from alternative city samples and interpolation techniques. Clearly, Black population grew most in D-graded areas. **Panel (b)** paints quite a different picture. Once extracting the Black-occupied and adjacent grades from the rest, we can see that the most pronounced growth in Black population percentage was in those HOLC areas that already had a substantial Black population or that were next to them. Moreover, the yawning gap separating D areas from C areas evident in **Panel (a)** all but disappears.

Looking at the quantities of Black population growth displayed in **Figure 6.6** below adds an additional layer of complexity to the narrative. Between 1940 and 1970—the postwar years where Aaronson and colleagues found HOLC grades to have their largest effect on Black residential concentration and the year in which Black populations in *Black10* and *Neighbor* areas peaked—about *seventy percent* of the Black population growth in D areas occurred in neighborhoods that either already had a substantial Black

population or that were adjacent to them. In that same time period, *nearly double* the number of Black residents moved to *B areas* than they did to non-Black, non-neighboring D areas. And over *five times* the number moved to *C areas*. This is in part due to B and C areas being more numerous and expansive than non-Black, non-neighboring D areas, but still, it demonstrates that Black in-migration was not, by any means, confined to D areas.

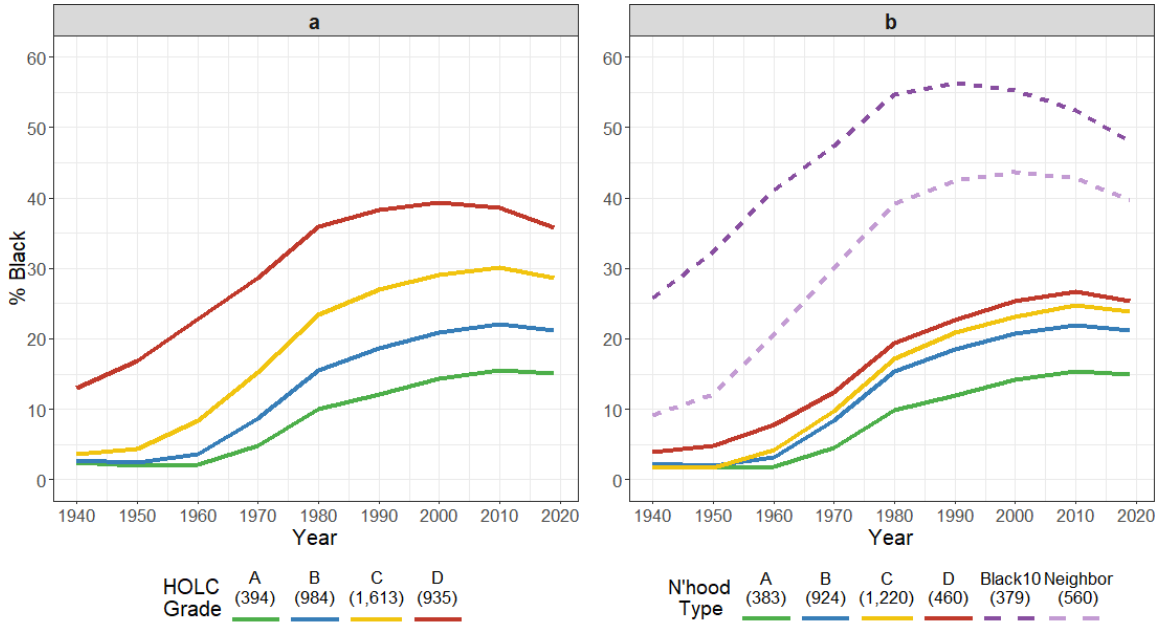


Figure 6.5. (a) Black population percentage by HOLC grade, 1940 – 2019. (b) Black population percentage by HOLC race/neighborhood type, 1940 – 2019.

Table 6.2. Distribution of HOLC grades by neighborhood category: Black10, Neighbor, and Neither.

HOLC Grade	Black10	Neighbor	Neither	*Total*
A	0	11	382	*393*
B	2	58	919	*979*
C	18	374	1,212	*1,604*
D	358	116	459	*933*
Total	*378*	*559*	*2,972*	*3,909*

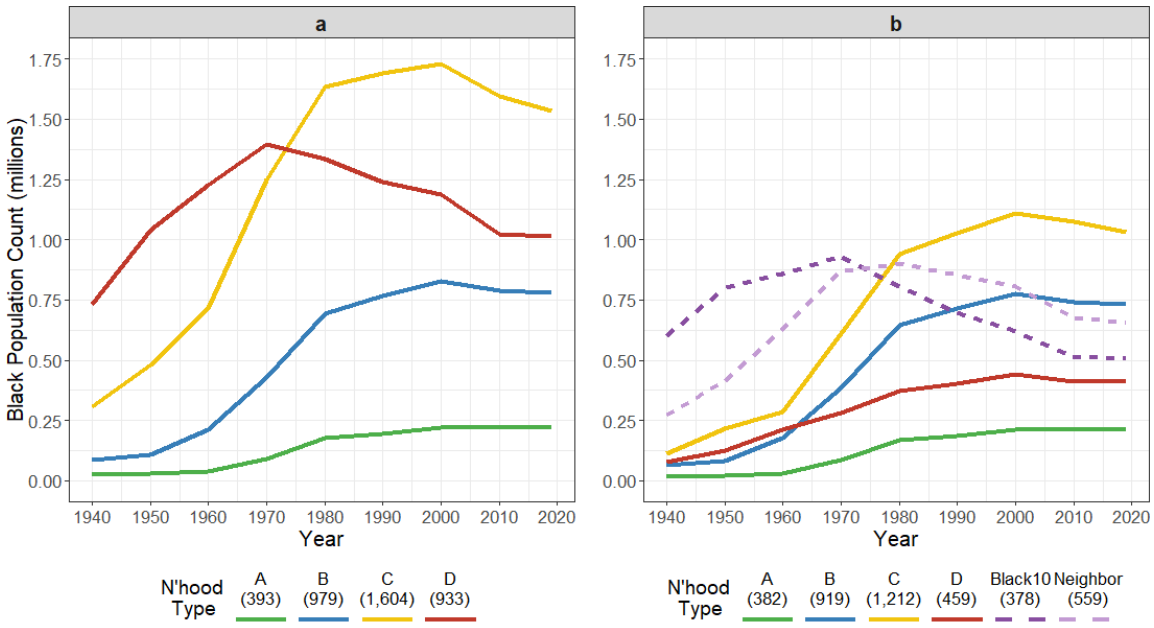


Figure 6.6. (a) Black population count by HOLC grade, 1940 – 2019. (b) Black population count by HOLC race/neighborhood type, 1940 – 2019.

Figure 6.6 also indicates something about the changing geographies of Black populations across the neighborhood grades. **Panel (a)** shows that the overall Black population count from 1940 to the present day grew most dramatically in C and B areas. It also shows sizeable Black population growth in D areas from 1940 to 1970, followed by a substantial decline. This drop likely reflects the combined effects of urban renewal, land abandonment, and Black suburbanization. Looking only at **Panel (a)**, it would seem that post-1970 Black population loss occurred most strikingly in D areas generally. However, **Panel (b)** refutes that interpretation. As it suggests, that large Black population loss did not occur evenly across D areas. Rather, it was concentrated almost entirely in those areas that had a large initial Black population or that were next to them. In the remaining D areas, this panel shows, Black population growth since 1960 occurred only

at about the same rate as it did in non-Black, non-neighboring A areas and far less than it did in non-Black, non-neighboring B and C areas.

Figures 6.5 and **6.6** give us some idea about the geographic distribution of postwar Black population change, revealing how it departed from the HOLC grade boundaries. What does this departure suggest about the changing geography of home values? Examining the census tract-level dataset can help with this. Specifically, by using census tracts as my unit of analysis, I can compare the correlations between tract-level median home values and both tract-level Black population share and HOLC grade coverage. Plotting these correlation coefficients (Pearson's r) by decade would then provide a simple depiction of how these relationships have changed over time.

Figure 6.7 below does just that. The HOLC grade colored lines—labeled in the legend as "Tract %"—indicate the percentage of the tract's dasymetrically refined surface area that is covered by the respective HOLC grade. This value is fixed throughout the study period, and it does not account for what other HOLC grades might by overlapping that tract. The lines labeled "Black" and "White" indicate the population percentage of those groups in that tract for the respective year. Like the *y* variable median home value and unlike the HOLC grade overlap, these numbers change through time. The study period includes all tracts that intersect the HOLC grade boundaries, so this dataset is generally limited to central cities and the areas immediately surrounding them that would become the earliest postwar suburbs.

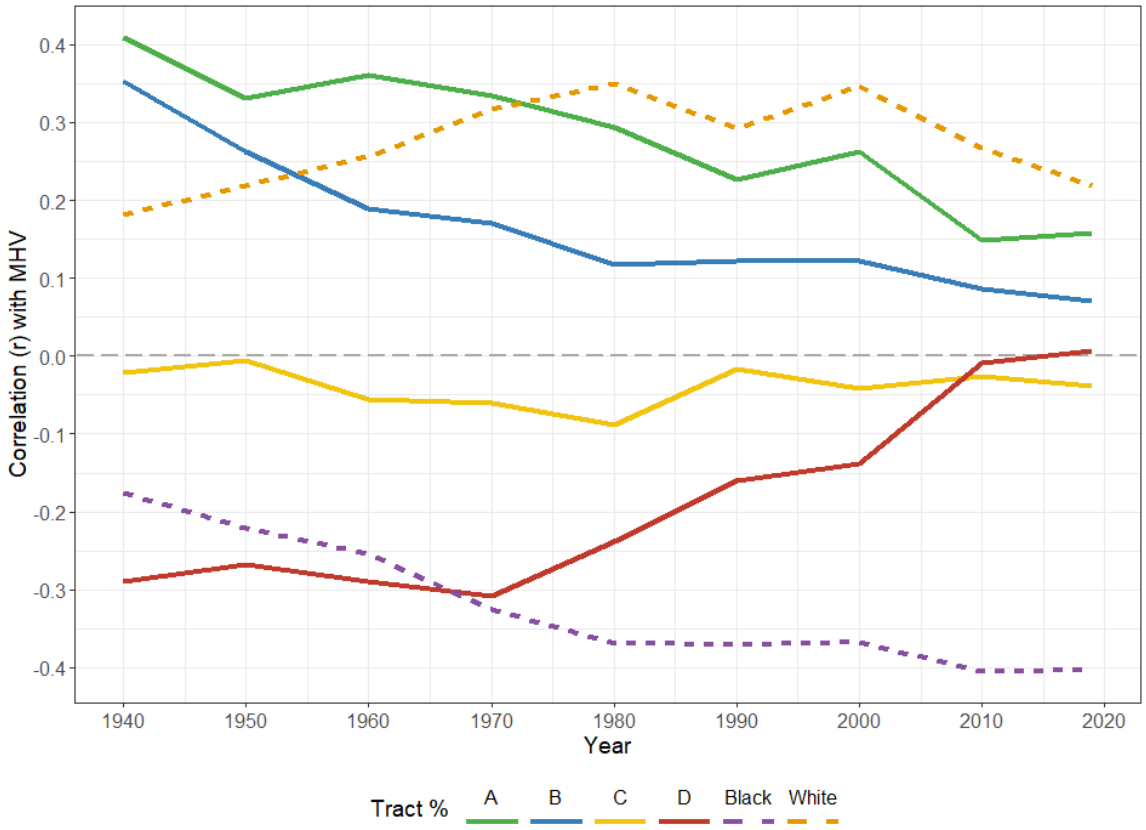


Figure 6.7. Correlations through time: Median home value (MHV), HOLC Grade, and Black and white population percentage by census tract.

The correlations are staggered in the way we would expect in the earlier years of the study period. The higher the proportion of a tract's surface area covered by an A-graded neighborhood in 1940, the higher its median home value tended to be ($r_{1940} = 0.41$). Conversely, the higher the proportion of tract's area covered by D-graded neighborhoods in that year, the lower its home value tended to be ($r_{1940} = -0.29$). Over time, the figure shows, the correlation coefficients for each of the HOLC grades trended toward zero, indicating that the relationship between home values and HOLC grade—as we might expect—was breaking down. On the other hand, home value's correlation with the white population share remained strong and positive even as definitions of whiteness

were dramatically changing, while that for the Black population share grew stronger and more negative. Though imperfect, this chart gives us some idea about how the relationship between neighborhood racial composition and home value strengthened through time—likely in part reflecting the growing spatial extent of Black urban neighborhoods.

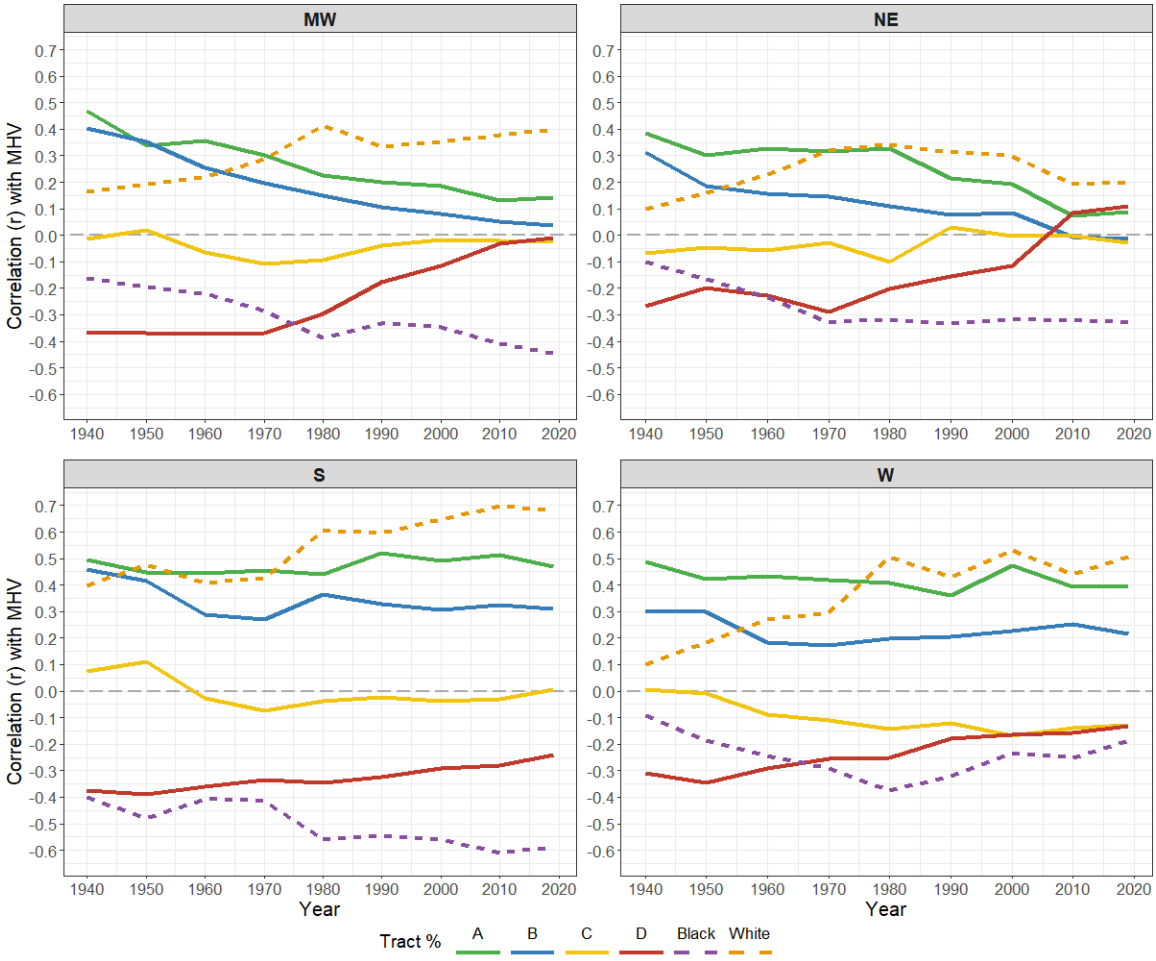


Figure 6.8. Correlations through time and region: Median home value (MHV), HOLC Grade, and Black and white population percentage by census tract in the Midwest (MW), Northeast (NE), South (S), and West (W).

Figure 6.8 breaks this graph down by region. As it suggests, these relationships looked similar in cities across the country near the beginning of the study period, but diverged noticeably as time passed. The HOLC grade lines' convergence toward zero primarily occurred in the Midwest (MW) and Northeast (NE), with D-graded areas even surpassing A-graded areas by 2010 in the Northeast. In the South (S) and West (W), by contrast, the gaps between HOLC grades' relationships with home values has largely persisted through time, especially in the South. In all regions, the white population share's positive correlation with home values eventually surpassed that of A-graded areas by 1980, while the Black population share's negative correlation dipped lower than the D-graded areas by that same period. The wide gap separating white and Black tract share is especially pronounced in the South, where the former closes in on a correlation coefficient of 0.7 and the latter approaches -0.6 by 2010.

Though only depicting correlations, these two charts support what I have been suspecting. As HOLC grade has become a weaker predictor of neighborhood-level home values over time, racial composition has become stronger. In other words, studies focusing on HOLC grade to explain present-day geographies of racialized devaluation are likely missing the more salient factor of racial composition itself. Or, to put it differently yet again, the analytical power of the HOLC maps is less in the physical boundaries of their grades than in the RTV that is reflected throughout their Area Description sheets. However, the descriptive analyses here are incomplete. They have not controlled for potentially confounding factors like household income or vacancy rates, and they compare two variables that are not exactly comparable—percent HOLC grade coverage

and percent Black. To conduct a more thorough decoupling of race and HOLC grade, I turn to regression.

Regression Analyses

The aim of the regression analyses is to assess the independent effects of racial composition and HOLC grade on home values over time. Namely, I want to disentangle race from HOLC grade to examine which is the more potent predictor of median home value for each decade from 1940 to 2019. The challenge is that racial composition and HOLC grade are not independent from another. Indeed, the former was an important criteria for determining the latter. Furthermore, as Aaronson, Hartley, and Mazumder (2021) find, the relationship between Black residential presence and HOLC grade remained strong until at least 1970. Thus, I cannot simply compare standardized coefficients in a single model to get the information I want.

To weigh the effects of neighborhood racial composition and HOLC grade on home values separately, I conduct two pairs of analyses. Both sets include results from otherwise identical models that use HOLC grade neighborhood and census tract boundaries as their geographical unit of analysis. The first set illustrates the basic association between the variables of interest by running three simple regressions for each of the nine years in my study period (18 total). The first of these models demonstrates the changing relationship between HOLC grade and Black population percentage over time by regressing the former on the latter. In a similar fashion, the second and third models—presented in a single figure—look at the temporal relationship between logged median home values and (1) HOLC grade and (2) Black population percentage. None of these three models includes control variables. The idea is to trace how HOLC grade and Black

population share track with each other and with home values over time, producing a straightforward picture of how each of these associations changed through the years.

The second set of analyses adds a layer of complexity. They include relevant control variables to assess the added proportional effect of HOLC grades and Black population share on home values. To conduct this analysis, I run four regression models for each year in the study period (36 total). The first is a *base model*, which regresses a logged median home value on a vector of controls. This model does *not* include HOLC grades nor Black population share as independent variables. The second is a *full model*, which adds the HOLC grade and Percent Black variables. The third is an *Only HOLC model*, which adds the Percent Black variable but not the HOLC grades. And the fourth is an *Only Percent Black model*, which does the opposite: it adds the HOLC grades but not the Black percentage variable. The *base model* is shown in **Equation 6.1**, and the *full model* is shown in **Equation 6.2**.

$$\log(mhv) = \beta_0 + \beta_1 mhi + \beta_2 oth + \beta_3 occ + \beta_4 sfd + \beta_5 log(d) + \beta_6 uy + \beta_7 met + \varepsilon \quad (6.1)$$

$$\log(mhv) = \beta_0 + \beta_1 x + \beta_2 b + \beta_3 g + \varepsilon \quad (6.2)$$

In both equations, mhv is the median home value, and ε is the error term. In **Equation 6.1**, mhi is median household income, oth is the percentage of the population that is neither white nor Black (Other), occ is the occupancy rate, sfd is the proportion of housing units that are single-family detached, d is the linear distance to the city hall building of the nearest primate city in meters, uy is the average urbanization year, and met controls for metropolitan area fixed effects. In **Equation 6.2**, x is a vector that includes all variables present in the *base model*, b is the Black percentage of the HOLC

neighborhood's population, and g includes the four A-to-D HOLC neighborhood grades.[18]

In **Equation 6.2**, the distance to city hall (d) is a proxy for the distance to downtown. This geocoded city hall data comes from Esri.[19] This models' average urbanization year (uy) variable captures the approximate age and density of the HOLC neighborhood, and it comes from the HHUUD10 dataset's UY2 variable (Appendix A). Ideally, I would include other racial groups besides a catch-all "Other" category in this model, but the Census has not consistently provided detailed race data other than for white, Black, and Other populations. Of course, the historical fluidity of these categories poses additional challenges for interpreting results, but this issue is inherent to all statistical studies that include racial variables and hence reflects an unavoidable shortcoming of this approach generally.

Running these four models—*base*, *full*, *Only HOLC*, and *Only Percent Black*—allows me to examine how the exclusion of the variables of interest affects the overall model fit (R^2) over time. To accomplish this, I start by first running the *base model* for each year in the study period. Then, I run the *full model*. The difference in the R^2 value between these two models indicates how much of the variance of the *y* variable—the logged median home value—is being absorbed by adding the HOLC grade and Percent Black variables together. Once obtaining that difference, I run the *Only HOLC model* and

[18] Since the oth variable is connected to Black population percentage, I tested a series of models that removed it from the *base model* and added it to the *No Black* model. The result was to strengthen slightly the effect of neighborhood racial composition on home values relative to HOLC grades as expected, though the difference was mostly negligible. Black population percentage was clearly the more salient racial variable of the two, so I opted to isolate Black population share in its own model rather than combine them into a composite model.
[19] Esri's US Federal Data: https://www.arcgis.com/home/item.html?id=462b08b0811c4a77aa09afc36c4f4b73.

Only Percent Black model separately. The resulting R^2 from these models reveals what percentage of the R^2 difference between the *base* and *full models* can be explained by HOLC grade and Black population share, respectively. Then, it is a matter of comparing the results. If the R^2 percentage change is higher for the *Only HOLC model* than the *Only Percent Black model*, it suggests that a neighborhood's Black population share is pulling on its home values more strongly than its HOLC grade for that year and vice versa.

For the HOLC neighborhood-level model, the procedure is straightforward. The HOLC grade is already assigned. The models thus treat their A-to-D grades as categorical variables. For the harmonized tract model, there is an additional challenge: how do I assign HOLC grades to tracts when their borders do not cleanly align? Researchers have often aimed to assign one HOLC grade per census tract (*e.g.*, Krimmel, 2017). However, tracts often overlap several HOLC grades and non-graded areas at once. I therefore choose an alternative approach that relies on percentage overlaps instead. Each tract in the harmonized tract analyses thus has six variable columns corresponding with their proportional overlap with six HOLC categories. These include the four A-to-D security grades, the Industrial/Commercial districts, and the non-graded areas. The HOLC grades are provided as geocoded polygons from the DSL, but to get the Industrial/Commercial districts, I digitize those boundaries from the original HOLC maps myself. This approach then allows me to treat these proportional overlaps as variables in themselves.

Table 6.3. Summary statistics (means) of the full models' variables.

	Variable	Unit	1940	1950	1960	1970	1980	1990	2000	2010	2019
y	*MHV*	$	4,849	11,469	16,566	22,388	57,979	131,181	179,030	296,165	369,261
HOLC Grade	*A**	0, 1	0.101								
	B	0, 1	0.250								
	C	0, 1	0.411								
	D	0, 1	0.238								
Race	*% White**	%	94.2	93.1	89.0	80.6	70.9	65.0	57.9	55.5	46.7
	% Black	%	5.5	6.6	10.1	15.8	23.1	26.2	28.1	28.7	27.1
	% Other	%	0.3	0.3	0.9	3.6	6.0	8.8	14.0	15.8	26.2
Dynamic Controls	*MHI*	$	2,381	4,517	7,553	11,598	18,013	33,856	46,428	56,464	68,486
	% Vacancy	%	4.6	3.1	10.3	4.2	5.4	7.3	7.1	10.9	12.1
	% SFD	%	54.2	53.8	58.0	56.0	49.0	51.6	51.9	50.4	50.5
Static Controls	*DDT*	m	11,881								
	UY	year	1941.5								
	*MW**	0, 1	0.418								
	*NE**	0, 1	0.285								
	*S**	0, 1	0.117								
	*W**	0, 1	0.180								

*variable does not appear in actual model
MHV = median home value; MHI = median household income; DDT = distance to downtown; UY = urbanization year; variables with grayed spaces have same value for all study years

Table 6.3 includes the summary statistics for each variable in the *full model* for each decade in the study period. The mean value for each variable in each year is listed. The dependent variable (MHV), the racial composition variables, and a subset of the controls are time-varying, whereas the HOLC grades and the rest of the controls are constant. The actual model used in the analyses includes metropolitan level—rather than regional level—controls, but for the sake of concision, only the regional means are presented in the table. As the table suggests, neighborhoods in the Midwest (MW) and Northeast (NE) are overrepresented in the sample, while those in the South (S) and West (W) are underrepresented. This in part reflects the greater number of cities in the former two regions, but it is also a result of cities in those regions have a greater number of neighborhoods on average (see **Table 6.1**).

Regression Results

Results from the first regression analysis are presented in **Figures 6.9** and **6.10**. **Figure 6.9** traces the relationship (R^2) between Black population percentage (y) and HOLC grade (x_1) from 1940 to 2019. For both the HOLC neighborhood-level and the harmonized models, the figure shows that after the model's R-squared value increased from 1940 to 1950—likely due to a jump in the urban Black population in D-graded areas during the 1940s—it has declined every decade since. This suggests that over time, HOLC grades have become a weaker predictor of Black population distribution within cities. This fact in itself should not be especially surprising. As the maps and graphs in the previous sections indicate, Black urban population growth was not confined to D-graded areas. Rather, it tended to grow directionally from an initial D-graded area. With

the trend presented here, we might then expect some divergence between HOLC grade and Black population share when it comes to their respective associations with home values.

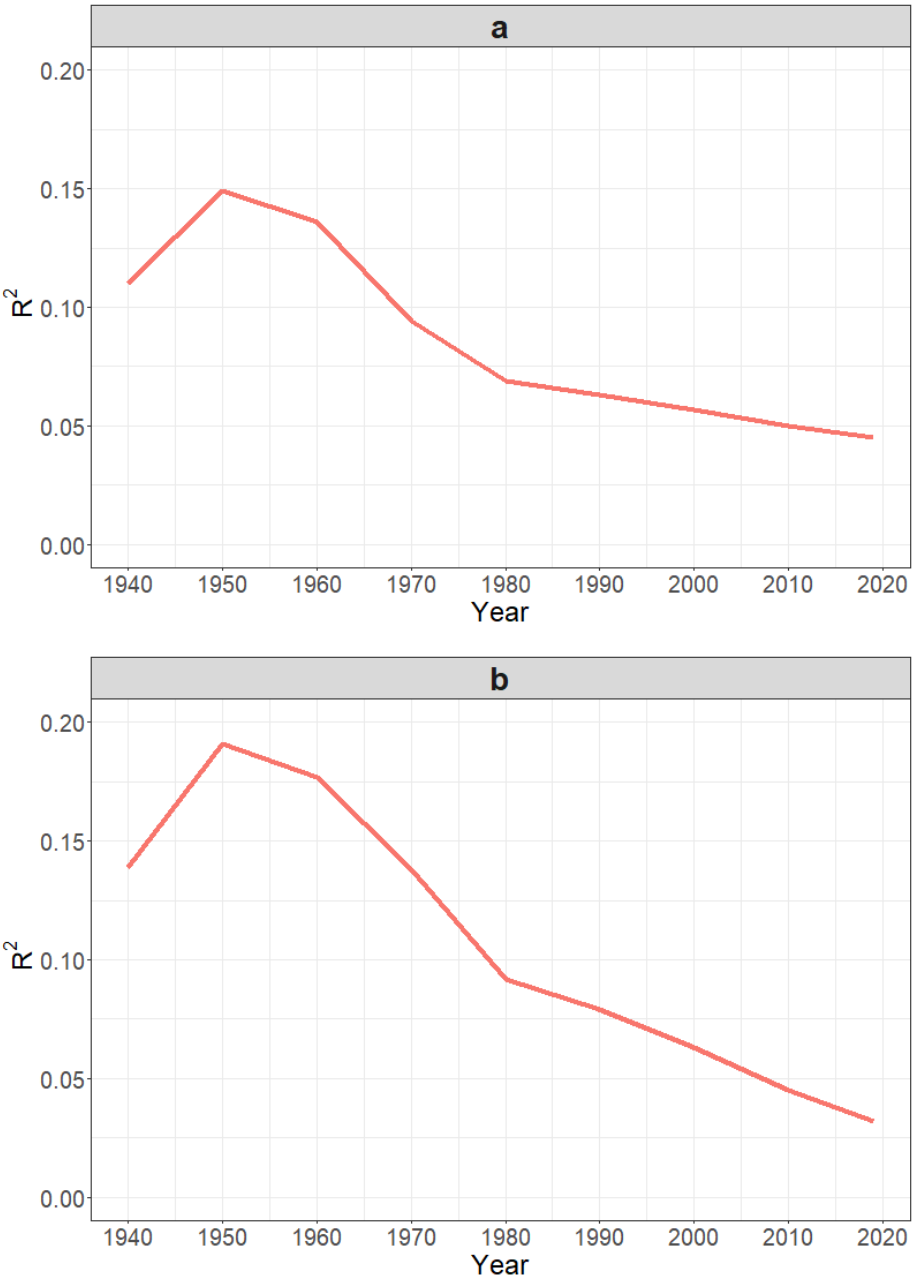


Figure 6.9. Relationship between HOLC grade and Black population share, 1940 – 2019 for (a) the HOLC neighborhood-level model and (b) the harmonized tract model. The R-squared value is from a regression model in which the dependent variable is the Black population percentage, and the independent variables are the HOLC grades.

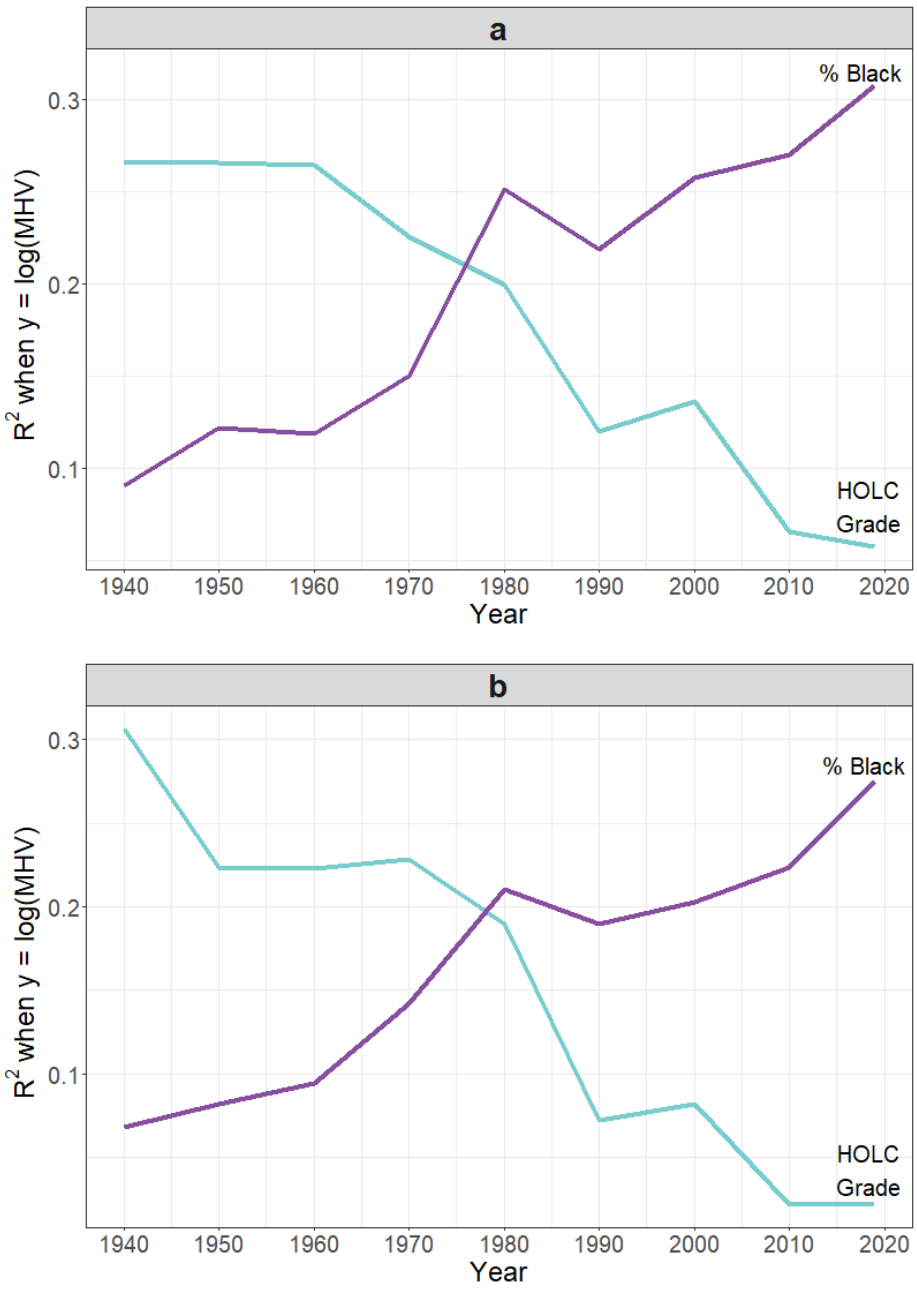


Figure 6.10. Relationship (R^2) between the logged median home value (MHV) and (1) HOLC grade and (2) Black population percentage, 1940 – 2019 for (a) the HOLC neighborhood-level model and (b) the harmonized tract model.

In **Figure 6.10**, the "HOLC Grade" line depicts the R^2 value for the model that regresses the logged median home value on the HOLC grades alone, and the "% Black"

line shows the same for the model that regresses that same y variable on the Black population percentage alone. Affirming what **Figures 6.7** and **6.8** show above, these charts indicates that the relationship between HOLC grade and median home value was much stronger than that between Percent Black and home value from 1940 to 1960 before switching places. And this result holds regardless of neighborhood definition. The reason for this earlier gap is fairly straightforward. HOLC grades themselves were devised largely to capture the present and anticipated level of home values (see Chapter Five). A-graded areas were considered the best areas that would yield the highest returns, while D areas presented the most risk which, by definition, had the lowest home values on average. Since all grades in the study area were assigned between 1937 and 1940, HOLC grades should be closely associated to neighborhood home values in the earlier years of the study period.

By 1980, the figure shows, the relationships flipped. A neighborhood's Black population share was more closely related to its median home value than its HOLC grade. Again, this changing relationship makes sense. The HOLC grades were drawn in the late 1930s and 1940 to capture neighborhood-level risk factors for property ownership. As people and capital moved through space throughout the next eighty years, we should expect that the connection between temporally stationary HOLC grades and temporally dynamic home values would weaken. The Quantitative Culpable literature's narrow emphasis on the lasting connection between HOLC grades and present-day outcomes—which downplay the diminishing strength of these relationships—obscures this plain expectation. Conversely, we should expect that the connection between two temporally dynamic variables—home values and Black population share—to remain fairly strong

through time *if* the RTV was to maintain its potency. **Figure 6.10** clearly suggests that it does. What is perhaps surprising is that this relationship has actually grown stronger, though others have identified a similar trend using census tract data (*e.g.*, Howell and Korver-Glenn, 2021).

Before expounding on what might be going on here, it is worth turning to the second regression analysis, which adds controls to the models and looks at how much HOLC grade and Black population share independently improve the *base model*'s fit. Its results are displayed in **Figure 6.11**. The y-axis shows the percentage difference in the R^2 of the *base model* and the *full model*. The *HOLC Grade line* being close to one hundred in 1940 means that neighborhood HOLC grade explained nearly 100 percent of the difference in the fit between the *base* and *full models*. On the other hand, the *% Black* line being near zero in that year suggests that neighborhood Black population share explained almost none of that difference. Since I am focusing on just these two variables, their line values each year will closely mirror one another. Their yearly sums will come close to 100, but since there is considerable overlap between HOLC grade and Percent Black variables themselves (see **Figure 6.9**), their values never add up to 100 exactly.

Here again, we see the switch in both models. From 1980 on, a neighborhood's Black population share was a far more salient predictor of its home values than its HOLC grade assignment, even after adding the controls listed in **Equation 6.3**. The diminishing importance of HOLC grade explained above equally pertains to these graphs. The increasing importance of the Black population share relative to HOLC grade deserves more consideration.

Figure 6.11. Percent of difference in R-squared value of base and full model explained by the independent addition of HOLC Grade and Percent Black, 1940 – 2019 for (a) the HOLC neighborhood-level model and (b) the harmonized tract model.

There are, I surmise, two major factors contributing to the growing significance of Black neighborhood share on home values. First, it reflects the growing spatial scale of Black urban neighborhoods across the timeframe. As the maps in **Figures 6.1** through **6.4**

show, HOLC neighborhoods at the time of the surveys contained much more racial heterogeneity than they would later. As the sheer extent of Black urban settlement grew over the twentieth century due to the Second Great Migration and postwar/post-civil rights era white flight, any existing connection between neighborhood racial composition and home values would have likewise scaled up. Thus, while the relationship between Black population concentration and home values pre-1980 may well have been stronger than **Figures 6.10** and **6.11** suggest, it would have likely been operating at the sub-HOLC neighborhood and sub-tract scales, rendering it imperceptible to these models. The regressions could have only registered a significant race-value connection when the spatial extent of Black urban settlement met a minimum threshold for statistical observability, and for much of the study area, that may not have been until 1980.

Second, it is likely that the RTV became more entrenched over the time period. A look at HOLC's Area Description sheets reveals an RTV that was very much in formulation at the time (see Chapter Five). The concentrated presence of many groups that would become white—first- and second-generation Eastern and Southern European immigrants, for example—was, at that time, considered detrimental for property values. Thus, many areas with low Black population shares and high white population shares (defined by the Census) still had notably low home values in the earlier years of the study period, disrupting the statistical correlation between Black population share and home value (see Roediger, 2005). Over the second half of the century, as second- and third-generation European immigrants became white and moved to the suburbs, the link between Blackness and anti-value would have strengthened by the plain fact that other

previously devalued groups lost their attachment to anti-value while Black residents did not (see Chapter Two).

Conclusion

A rapidly growing body of research has aimed to highlight the persistent legacies of racist housing policy by statistically linking HOLC grade boundaries to a diverse array of present-day inequities. Most typically, these studies argue that contemporary manifestations of devaluation—such as reduced home prices, pollution, adverse health outcomes, and the like—are significantly concentrated within the areas on the HOLC maps that were assigned a D grade. The argument, often merely implied, is that the maps caused the later outcomes. Though this contention has been widely accepted, it suffers from a major problem: scholars have thus far been unable to find evidence that the maps ever actually informed lending decisions. In light of this issue, a second problem with these HOLC Culpable arguments arises. By hyper-focusing on HOLC grades, these studies may well be *downplaying* the power of racism by masking a stronger effect between present-day forms of devaluation and Black population share. That is, they are underestimating the power of what Abrams (1955) called the "racist theory of value."

In this chapter, I tested the extent of this concern by examining the changing geographies of home values. Specifically, I disentangled race from HOLC grade to compare the independent effects each had on neighborhood-level home values over time. Using descriptive and inferential statistical methods, I found that since 1980, a neighborhood's Black population share has been a more potent predictor of its home value than its HOLC grade. In fact, since 1960, these analyses showed that HOLC grades

have become a weaker and weaker predictor of home values as Black population share has become stronger and stronger. Thus, if the aim is to illustrate how racist policies and practices from the past continue to reproduce socio-spatial inequities in the present, scholars should focus more directly on the uneven geographies of race rather than obliquely through an analysis of HOLC grades. Among other things, this entails a re-envisioning of how the HOLC mapping materials ought to be studied. It suggests that their power is less in revealing which areas today were assigned which grades than in reflecting how a real estate industry that was undergoing its most dramatic transformation to date was developing a notion of value that depended on a neighborhood's perceived racial character.

CHAPTER 7

CONCLUSION

In 2018, the real estate pricing tech giant Zillow entered the home buying business. Having amassed one of the largest caches of home sales data in the United States, the idea was that the company's housing price algorithm—producing their trademarked "Zestimate"—could predict home value changes in neighborhoods across the country. With this information, they could then automate strategic property purchases and sales through a process referred to as "iBuying," giving them a lucrative advantage over the human competition. At least, that was the plan behind the Zillow Offers program. By the end of 2021, the initiative had been shut down. In that year alone, Zillow Offers cost the company close to a billion dollars, reportedly leading to the layoff of about a quarter of its 8,000 employees (Parker, 2022). In his announcement to shareholders, Zillow founder, CEO, and champion of the Offers program Rich Barton admitted defeat, "We've determined the unpredictability in forecasting home prices far exceeds what we anticipated" (quoted in Gandel, 2021).

When Zillow Offers was launched, the company touted the "cutting edge neural network and artificial intelligence technologies" used to build its pricing algorithm (Zillow, 2019). Tech journalists, too, labeled the program "disruptive," suggesting that Zillow's "iBuying" strategy could do to the real estate business what "Uber, Netflix and

Airbnb [had] done in their respective industries" (Gordon, 2019; see also Dezember and Rudegeair, 2019). When the program went bust, much of the media attention focused on the mechanics of the algorithm, with commentators speculating about how a more advanced AI model with more sophisticated assumptions could have really worked (*e.g.*, Kiger, 2021; Sherman, 2022). Missing in the buzz was a recognition that while Zillow's particular technology may have been new, real estate capital's preoccupation with using data science to predict home prices was decidedly not. Rather, Zillow Offers represented only the latest iteration of a century-long project to anticipate trends on the sub/urban housing landscape.

Writing eighty years earlier, the Principal Housing Economist of the Federal Housing Administration's (FHA) Division of Economics and Statistics, Homer Hoyt, expressed his hope for soon achieving a similar goal. In his 1939 monograph best known for introducing his "sector model" of cities, *The Structure and Growth of Residential Neighborhoods in American Cities*, Hoyt opened by acknowledging the challenge, "The American city at first glance may well give the observer an impression of almost utter confusion" (Hoyt, 1939, p. 3). The purpose of his study was therefore to "[furnish] the tools for analysis and [develop] principles of general application" to enable the "intelligent examination of the internal structure and growth of American cities" (*ibid*.). In short, Hoyt wanted to cut through what may first "appear to be a chaotic jumble of structures in the urban community" (*ibid*.). He wanted to establish some degree of order and rationality to better understand the urban landscape, to "give an insight into the causes of the present arrangement" (*ibid*.), to grant government and industry the tools to anticipate growth and change.

To accomplish this task, Hoyt—like Zillow—would make use of big data. As he put it in the Forward, he would leverage an "imposing body of statistical data"—the real property surveys compiled by the Works Progress Administration (WPA)—which "covered detailed housing characteristics more extensive in magnitude and more intensive in coverage than had ever been gathered before" (1939, p. IV). Collected between 1934 and 1938 and covering 203 cities of various sizes, locations, growth trajectories, and economic characteristics, this data would make possible "a scientific analysis of city structure that would heretofore have been impossible" (*ibid*.). Such a task, Hoyt believed, was called for, even necessary, because as he saw it, "a whole series of vital urban problems" (1939, p. 3) required data-driven solutions. In his words:

> The selection of areas for slum clearance, the determination of mortgage lending policy by areas, and decisions in regard to zoning or rezoning of sections for given types of land use all depend upon the forces governing the interrelationship of different types of areas and the past and prospective movements of different types of neighborhoods. (*ibid*.)

Hoyt and the FHA were not alone in their quest for developing data-driven, scientific principles for studying cities. As he documented in the Forward, "techniques for making real property surveys" (1939, p. IV) had been "refined through cooperative efforts" of several newly formed federal agencies. In addition to the WPA and the FHA, this included the Central Statistical Board, the Housing Division of the Public Works Administration, and most notably, the Federal Home Loan Bank Board (FHLBB), which housed the Home Owners' Loan Corporation (HOLC). Staffed with the country's leading housing experts from academia and industry, these agencies pursued a series of data-

gathering operations unprecedented in scale and scope, driven by the belief that many of the failures of the Great Depression's housing economy could be overcome through technocratic, data-driven solutions.

These efforts, it should be noted, did underlie some qualified successes. For instance, they supported the federal government's promotion of long-term, fixed-rate mortgages, which reduced the costs of homeownership (Immergluck, 2009; McCabe, 2016). After all, for banks and thrifts to issue twenty- and later thirty-year mortgages, they needed to have some sense of how a given area would change over that time. What better way to make those predictions than by adhering to a set of federally endorsed scientific principles on the factors underlying sub/urban change? However, these technocratic fixes were not capable of averting crisis completely. They could only ever inform expectations about what might happen in a place, and provide lenders, policymakers, property developers, and speculators a blueprint of a future they could help create. If the data analysis suggested that property values were destined to decline in an area due to, say, racial transition, real estate capital would more likely pull its investments and government agencies would more likely earmark funds for "slum clearance," ensuring that the devaluation predicted by the analysis would occur.

These technocratic fixes could thus never benefit all parties equally. To the extent that these data tools—along with the government subsidies that accompanied them—helped make homeownership more affordable to the average white household, they did so at the expense of Black households. Developed by and for real estate capital, these early examples of big housing data science were designed with the present and future profitability of home lenders, brokers, and developers principally in mind. During the

Great Depression, these industries' investments were largely tied up in unprofitable places, particularly urban centers with stagnant property values and high levels of mortgage default, which often either had a Black plurality or were adjacent to Black-plurality neighborhoods. What real estate capital needed, Hoyt, the FHLBB, and these other federal agencies implicitly recognized, was a scientifically acceptable rationale for cutting those losses, for sacrificing those areas for the good of the system.

In this dissertation, I have argued that the development and implementation of the "racist theory of value" (RTV) (Abrams, 1955) was a key innovation in this effort. Bolstered by early data science, endorsed by federal agencies, professional organizations, and industry experts, and backed by government subsidy, the RTV allowed real estate capital to better predict and control the value trajectory of neighborhoods across the sub/urban housing landscape. By engineering a definition of value tied to race, claiming this definition was an unshakable law of real estate science—of "realology" (Hornstein, 2005)—and then enacting policy as if it were so, the real estate industry could, in the words of Rose Helper (1969, p. 33), "anticipate [the racial trend]" and "help to turn it in a certain direction." This would provide a major new advantage to real estate capital. And it would underpin the unprecedented expansion of white homeownership-based wealth during the postwar decades.

The close connection between the emerging science of real estate and the RTV is plainly evident in the very same FHA document published by Hoyt (1939). While Hoyt spent the Forward and Introduction heralding recent advancements in big housing data and city science, he dedicated the rest of the document to demonstrating how these advancements allowed him to identify patterns and trends on the urban landscape. As

students of urban geography, planning, and sociology will recall, much of this was about challenging Park and Burgess's (1925) "concentric zone model" of cities. Using data from the WPA surveys, Hoyt showed in his sample of cities that urban land uses and rents tended to cluster less in concentric rings radiating out from the Central Business District than in concentrated sectors shaped by transportation infrastructure, physical geography, historical development patterns, so-called residential "filtering," and the locational preferences of the wealthy. Less well remembered is the role of race in Hoyt's calculus, particularly in his lengthy discussion about the intra-city geographies of rent.

Understanding the changing geographies of rent was of "unusual importance" to Hoyt (1939, p. 112). Of all the shifts that take place on the urban landscape, he noted, "the movement of the residential rental neighborhoods most vitally concerns the home owner or the investor in residential mortgages" (*ibid*.). Accordingly, he considered the "forces affecting the pattern of movement of residential rental areas" to be the "main subject of [the] monograph" (p. 111). Through his spatial analysis of the data furnished by the WPA's real property surveys, he emphasized seven block-level factors that closely corresponded to a block's average rent. These included the age of the block's structures, its tenant occupancy (proportion of renters versus homeowners), the condition of its dwellings, its proportion of units lacking a private bath, proportion of units lacking central heat, proportion of overcrowded dwelling units, and its nonwhite occupancy.

Always careful with his phrasing, Hoyt never outright stated that Black presence caused rents to decline. In fact, he made sure to clarify that there "are many slum areas tenanted by whites which are in as poor or worse condition than areas tenanted by nonwhites" (1939, p. 54). Rather, using the facially neutral language of science, Hoyt

preferred to point out correlations, tendencies, and observations ostensibly supported by maps and data. He preferred to leave it to the reader to connect the dots. For instance, to highlight the significance of race "in any study of rent gradations," Hoyt noted that the "presence of even one nonwhite person in a block otherwise populated by whites may initiate a period of transition" (*ibid*.). Then, in the following paragraph, using Richmond, VA as an example, he observed:

> The nonwhite population of this city at the time of the survey [which is later acknowledged to be mostly Black] was almost entirely in blocks in which rent averaged less than $20 per month. Almost half the blocks in the lowest rental category were fully occupied by nonwhites…In the highest rental grouping, all occupants were white. There is thus a distinct tendency for blocks occupied by nonwhites to fall into lower rental groups. This is principally reflective of the economic conditions of the nonwhite population. In relation to gradations of rent, therefore, nonwhite occupancy is of significance. (*ibid*.)

Though careful to elide causal language, this assessment leads the reader toward only two conclusions. First, concentrated Black occupancy, at the very least, is indicative of reduced rents, which—Hoyt points out—signaled obsolescence. Second, since the racial transition may occur fairly rapidly after the "presence of even one nonwhite person in a block otherwise populated by whites," then Black presence is, at the very least, a sign of ensuing devaluation. Here again, we see the RTV in action. With Hoyt, as with the HOLC maps, it was expressed not as a baldly racist screed against the dangers of race mixing and miscegenation that marked a prior era but as a plain, if unfortunate, fact of the

world. Indeed, much of the potency and durability of the RTV is owed to its origins in early urban land use science. Lent credence by towering figures like Homer Hoyt and Frederick Babcock, as well as by state-backed agencies and institutions like the FHLBB, the FHA, and the National Association of Real Estate Boards (NAREB), the RTV was afforded a level of respectability that practically elevated it to unarguable common sense.

The possibility that the coincidence of low rents and "nonwhite occupancy" could have been the result of racist policies and practices that discriminated against Black workers and restricted them to the oldest neighborhoods in the least desirable parts of the city never factored into the analyses. For Hoyt, the FHA, and HOLC, it was beside the point because it was only ever the correlation—and not the cause—that mattered. What would challenging racial discrimination in employment and housing do for real estate capital? What would correctly diagnosing the cause of racial value segregation do? Unquestionably accepting these correlations as observed, on the other hand, came with clear advantages. By linking whiteness to value and Blackness to anti-value, real estate capital could—to a greater degree than previously—forecast and control the value trend in an area. The RTV thus enabled real estate capital to transform the circumscribed movement of Black people into the circumscribed movement of devaluation. In this way, the RTV assisted capital in demarcating the places to both store devaluation away from valued white areas and serve as targets for hyper-extraction and dispossession.

As Hoyt's (1939) FHA-published monograph and HOLC's City Survey program attest, the widespread application of the RTV in private and public policy documents throughout the 1930s and 1940s was inseparable from these institutions' growing faith in the power of data science. For them, neighborhood racial composition and its anticipated

changes over time were key variables in the equations to determine the risk a given area posed to property owners. The City Survey program's Area Description sheets, even more than Hoyt's (1939) monograph and perhaps more than any other documents from the time, plainly illustrate this relationship. As the product of an initiative devised to gather and assess neighborhood-level data pertinent to housing, the Area Description sheets and their accompanying maps demonstrate the centrality of race in the ascending science of real estate. Not only were the Black and "foreign-born" population shares part of the grading criteria, but they were among the most significant factors. Any Black presence at all was almost always a sufficient reason in itself to assign an area a D grade (Winling and Michney, 2021).

Most of the HOLC literature until this point has centered on this fact. However, as I stress throughout this dissertation, this body of work—which falls into a camp I have labeled "HOLC Culpablism"—has generally missed the broader significance of HOLC's maps and notes for studying the emergence of the RTV. It has, in short, limited the types of questions it can ask by fixating on the D-grade boundaries. In doing so, scholars have papered over the matchlessly detailed account of the RTV in action that is provided in the Description sheets. They have built up a misleading—if not downright false—narrative about how the HOLC maps were used. And they have underestimated the ongoing power of racism in shaping present-day geographies of value and anti-value.

Rather than discard HOLC Culpablism altogether, I have sought to recapture its spirit, which is anchored by the right anti-racist impulses originally articulated by Kenneth Jackson (1980, 1985). My aim, in part, has therefore been to reimagine the City Survey program and its mapping materials anew. To do that, I have addressed the

shortcomings of the extant HOLC literature head on. For example, I have treated the maps and notes as two indivisible parts of a whole, underscoring both the relationality and internal variability of the map grades. As part of this effort, I have given the Description sheets the weight they deserve, dedicating Chapter Five to exploring the cartographic narratives expressed throughout their pages. In that chapter, I found that the map grades alone tell only a small part of the story. When read alongside the spatial narratives in their Description sheets, the map grades no longer seem so static, finite, and isolated. Instead, they appear as crudely defined categories slapped onto a landscape that appraisers viewed as far more complicated, unruly, and interconnected than four discrete grades could ever capture.

By recognizing and then cutting through that simplification, I was able to gain a much more complete view of how HOLC's field agents understood the RTV and incorporated it into their neighborhood appraisals. Specifically, I identified a RTV in formation, which was operationalized distinctly across my two study cities: Milwaukee and Atlanta. In the former, Black presence was discussed as a sign indicating that a residential neighborhood had reached the end state of its life cycle: total obsolescence. In the latter, Black presence was seen more as a potent type of disamenity, one that radiated anti-value into surrounding areas, damaging property values there. Surprisingly, future white-to-Black neighborhood transition was not expressed as a concern—or even a possibility—in either city's Area Description sheets. However, by framing Black presence as sign and source of obsolescence, respectively, both accounts outlined ready-made economic rationales for efforts to contain Black movement.

I have also approached my analyses with a full acceptance of the near certain fact that the maps and notes were not actually used to make lending decisions. Rather than trying to maintain the fiction that the maps themselves directly informed lending policies, I have treated HOLC's neighborhood appraisals more appropriately as part of an internal data gathering operation. Taking this approach, which is more supported by the historical record (see Michney, 2022), does not downplay the significance of the maps as some would fear, but, to the contrary, casts them in a new light that elevates their importance. Namely, this approach has allowed us to see HOLC's mapping materials not merely as instructions about how lenders should handle the few urban spaces depicted in them but as *reflective* of a broader ideology of value that was solidifying within the real estate industry at the time. Reframing the maps and notes in this way presents them as windows into how real estate capital was coming to understand the relationship between race and value in space and time on the eve of its most transformative project of the last century: postwar suburbanization. Additionally, treating the City Survey program as a data gathering operation positions it within a larger development that was emerging in that era and that has extended to today: the technocratic fantasy that science, data, and technology can circumvent the crises of capitalism. Indeed, the insights gleaned from Chapter Five were made possible through this approach.

Finally, in situating the City Survey program within racial capitalism, I have helped illustrate how a narrow focus on D-graded areas undersells the importance of racism in shaping the contemporary sub/urban housing landscape. This was the subject of Chapter Six, which was motivated by two major frustrations I have had with the extant literature. The first was my suspicion that the tidal wave of recent studies statistically

linking HOLC grades to present-day sociospatial inequities—a body of work I labeled "Quantitative Culpablism"—was masking a stronger relationship between the latter and the segregated geographies of race. The second was my growing irritation with the underlying implication of Quantitative Culpable scholarship that frames racism as an unremedied policy of the past rather than as an ongoing force that imbues the very market structures that undergird and organize social life in (racial) capitalism.

To address these co-related issues, I constructed a set of statistical analyses that decoupled neighborhood racial composition from HOLC grade assignment to assess their historical relationships with home values independently. This produced two major findings. First, it revealed that postwar Black urban population growth did not occur evenly across D-graded neighborhoods as so many have presumed but was concentrated primarily in the areas that either already had a substantial Black population at the time of the HOLC surveys or that were adjacent to them. Revisiting a point raised above, this finding highlights the importance of examining within-grade variability. Second, my analysis found that while HOLC grade was more closely associated with neighborhood home values than Black population share in the first few decades after the City Survey program, this relationship flipped in the 1970s. Since then, Black population share has been a more salient predictor of home values, suggesting that the strength of the race-value connection has been sustained or has even intensified over time while the map grades tell us less and less. This does not imply that HOLC's mapping materials have nothing to offer anti-racist scholarship but that HOLC research thus far has largely neglected what really makes them valuable.

The HOLC maps, in this way, share a crucial similarity with Zillow's pricing algorithm. The trouble always with such algorithms is that the input data is, by necessity, from the past. Thus, an underlying assumption is that the future will, in some key ways, look like the past. The Zillow Offers saga demonstrates the fragility of this assumption. The interwar predictions of neighborhood change conducted by HOLC—and Hoyt for that matter—were subject to that same vulnerability. Indeed, a remarkable feature of the HOLC notes is just how wrong the field agents ended up being about places. In both Atlanta and Milwaukee, appraisers frequently predicted decline in areas that would become some of the wealthiest in the region, and they did not foresee Black population growth in many areas that would become majority-Black in short order. In sum, they predicted that home values and neighborhood racial compositions would roughly follow the trajectories they had been on. Of course, appraisers could not have anticipated mass suburbanization, the Second Great Migration, the 1949 Housing Act, the Federal-Aid Highway Act, or the concomitant postwar economic boom, all of which rendered their prewar forecasts virtually obsolete. In some ways, the dramatic postwar transformation of the metropolis is what makes the continuity between the HOLC maps and present-day geographies of inequity interesting to study. But continuity is only one part of the story. The true value of the HOLC maps and notes comes less from what they got right about the future than from what they got wrong. In those discrepancies, I have argued, is where we see the sustained potency of the RTV.

Only a limited amount of information is publicly known about how Zillow computes its Zestimate. Generally though, modern home pricing algorithms employ some variation of the sales comparison approach, in which they estimate a home's present

value by comparing its attributes to those of recent homes that have sold for a known price. From what is publicly known, these models no longer include neighborhood racial composition as an input variable directly. However, the statistical associations they rely upon are built from the uncorrected legacies of racial discrimination (Howell and Korver-Glenn, 2018; 2021; Taylor, 2019). Moreover, discriminatory human-conducted appraisals still influence the results of comparison models. Recent stories sweeping the national press of Black families "whitewashing" their homes when it has come time to sell only to see their appraisals go up by tens to hundreds of thousands of dollars demonstrate this (*e.g.*, Endale, 2021; Johns, Robinson, and Chavez, 2021; Kamin, 2022). Even as the RTV no longer openly appears in government policy, it continues to reproduce racial inequity, inside HOLC boundaries and out.

REFERENCES

Aalbers, M.B. (2011) *Place, Exclusion, and Mortgage Markets*. Hoboken: Wiley-Blackwell.

Aalbers, M.B. (2014) 'Do maps make geography? Part 1: Redlining, planned shrinkage, and the places of decline', *ACME*, 13(4), pp. 525–556.

Aaronson, D. *et al.* (2021) 'The long-run effects of the 1930s HOLC "redlining" maps on place-based measures of economic opportunity and socioeconomic success', *Regional Science and Urban Economics*, 86, p. 103622. Available at: https://doi.org/10.1016/j.regsciurbeco.2020.103622.

Aaronson, D., Hartley, D. and Mazumder, B. (2017) *The effects of the 1930s HOLC 'Redlining' Maps*. Chicago: Federal Reserve Bank of Chicago. Available at: https://www.chicagofed.org/publications/working-papers/2017/wp2017-12#:~:text=We study the effects of,racial segregation in later decades.

Aaronson, D., Hartley, D. and Mazumder, B. (2021) 'The Effects of the 1930s HOLC "Redlining" Maps', *American Economic Journal: Economic Policy*, 13(4), pp. 355–392. Available at: https://doi.org/10.1257/pol.20190414.

Abrams, C. (1955) *Forbidden neighbors: A study of prejudice in housing*. New York: Harpers.

Airgood-Obrycki, W. (2019) 'Suburban status and neighbourhood change', *Urban Studies*, 56(14), pp. 2935–2952. Available at: https://doi.org/10.1177/0042098018811724.

Airgood-Obrycki, W., Hanlon, B. and Rieger, S. (2021) 'Delineate the U.S. suburb: an examination of how different definitions of the suburbs matter', *Journal of Urban Affairs*, 43(9), pp. 1263–1284. Available at: https://doi.org/10.1080/07352166.2020.1727294.

Allums, C.A., Markley, S.N. and Hafley, T.J. (2022) '"A better place to be"? Black Mecca, White democracy, and the contradictions of neoliberal cityhood in Atlanta's Black suburbs', *Journal of Urban Affairs*, 44(6), pp. 793–807. Available at: https://doi.org/10.1080/07352166.2020.1854612.

An, B.Y., Orlando, A.W. and Rodnyansky, S. (2019) *The Physical Legacy of Racism: How Redlining Cemented the Modern Built Environment, Working Paper*. SSRN. Available at: https://doi.org/10.2139/ssrn.3500612.

Anderson, M. (2020) ‘Racist housing practices from the 1930s linked to hotter neighborhoods today’, *NPR*, 14 January. Available at: https://www.npr.org/2020/01/14/795961381/racist-housing-practices-from-the-1930s-linked-to-hotter-neighborhoods-today (Accessed: 16 May 2022).

Anderson, M.J. (2015) *The American census: a social history.* Second edition. New Haven: Yale University Press.

Appel, I. and Nickerson, J. (2016) *Pockets of Poverty: The Long-Term Effects of Redlining, Working Paper*. Available at: https://doi.org/10.2139/ssrn.2852856.

Babcock, F.M. (1932) *The valuation of real estate*. New York: McGraw Hill.

Badger, E. (2017) ‘How redlining’s racist effects lasted for decades’, *The New York Times*, 24 August. Available at: https://www.nytimes.com/2017/08/24/upshot/how-redlinings-racist-effects-lasted-for-decades.html (Accessed: 16 May 2022).

Bailey, Z.D., Feldman, J.M. and Bassett, M.T. (2021) ‘How structural racism works — racist policies as a root cause of U.S. racial health inequities’, *New England Journal of Medicine*, 384(8), pp. 768–773. Available at: https://doi.org/10.1056/NEJMMS2025396.

Balk, D. *et al.* (2018) ‘Understanding urbanization: a study of census and satellite-derived urban classes in the United States, 1990-2010’, *PLoS ONE*, 13(12), p. e0208487. Available at: https://doi.org/10.1371/JOURNAL.PONE.0208487.

Baradaran, M. (2017) *The color of money: Black banks and the racial wealth gap*. Cambridge: Harvard University Press.

Bayor, R. (1996) *Race and the shaping of twentieth century Atlanta.* Chapel Hill: University of North Carolina Press.

Benns, M. *et al.* (2020) ‘The impact of historical racism on modern gun violence: Redlining in the city of Louisville, KY’, *Injury*, 51(10), pp. 2192–2198.

Berube, A. (2018) *City and metropolitan income inequality data reveal ups and downs through 2016*. Washington D.C.: Brookings Institution. Available at: https://www.brookings.edu/research/city-and-metropolitan-income-inequality-data-reveal-ups-and-downs-through-2016/.

Best, R. and Mejia, E. (2022) ‘The lasting legacy of redlining’, *FiveThirtyEight*, 9 February. Available at: https://projects.fivethirtyeight.com/redlining/ (Accessed: 16 May 2022).

Bhandar, B. (2018) *Colonial lives of property: Law, land, and racial regimes of ownership*. Durham, NC: Duke University Press.

Bledsoe, A. (2020) ‘The primacy of anti-blackness’, *Area*, 52(3), pp. 472–479. Available at: https://doi.org/10.1111/area.12599.

Bledsoe, A. and Wright, W.J. (2019) ‘The anti-Blackness of global capital’, *Environment and Planning D: Society and Space*, 37(1), pp. 8–26. Available at: https://doi.org/10.1177/0263775818805102.

Bloch, S. and Phillips, S.A. (2022) ‘Mapping and making gangland: a legacy of redlining and enjoining gang neighbourhoods in Los Angeles’, *Urban Studies*, 59(4), pp. 750–770. Available at: https://doi.org/10.1177/00420980211010426.

Bonds, A. (2019) ‘Race and ethnicity I: property, race, and the carceral state’, *Progress in Human Geography*, 43(3), pp. 574–583. Available at: https://doi.org/10.1177/0309132511427229.

Boschmann, E.E. and Cubbon, E. (2014) ‘Sketch Maps and Qualitative GIS: Using Cartographies of Individual Spatial Narratives in Geographic Research’, *The Professional Geographer*, 66(2), pp. 236–248. Available at: https://doi.org/10.1080/00330124.2013.781490.

Boston, A.T. (2021) ‘Manufacturing Distress: Race, Redevelopment, and the EB-5 Program in Central Brooklyn’, *Critical Sociology*, 47(6), pp. 961–976. Available at: https://doi.org/10.1177/0896920520986614.

Bradford, C. (1979) ‘Financing home ownership: the federal role in neighborhood decline’, *Urban Affairs Quarterly*, 14(3), pp. 313–335. Available at: https://doi.org/10.1177/107808747901400303.

Brown, L.T. (2021) *The Black butterfly: the harmful politics of race and space in America*. Baltimore: Johns Hopkins University Press.

Buttenfield, B.P., Ruther, M. and Leyk, S. (2015) ‘Exploring the impact of dasymetric refinement on spatiotemporal small area estimates’, *Cartography and Geographic Information Science*, 42(5), pp. 449–459. Available at: https://doi.org/10.1080/15230406.2015.1065206.

Byrd, J.A. *et al.* (2018) ‘Predatory Value: Economies of Dispossession and Disturbed Relationalities’, *Social Text*, 36(2), pp. 1–18.

Cacho, L.M. (2012) *Social Death: Racialized Rightlessness and the Criminalization of the Unprotected*. New York: NYU Press.

Capps, K. and Cannon, C. (2021) ‘Maps reveal redlined areas face higher flood risks’, *Bloomberg*, 15 March. Available at: https://www.bloomberg.com/graphics/2021-flood-risk-redlining/ (Accessed: 16 May 2022).

Capps, K. and Mock, B. (2019) ‘Who will presidential candidates’ redlining plans actually benefit?’, *Bloomberg CityLab*, 18 October. Available at: https://www.bloomberg.com/news/articles/2019-10-18/inside-2020-candidates-plans-to-address-redlining (Accessed: 2 September 2020).

Caquard, S. (2013) ‘Cartography I: Mapping narrative cartography’, *Progress in Human Geography*, 37(1), pp. 135–144. Available at: https://doi.org/10.1177/0309132511423796.

Caquard, S. and Cartwright, W. (2014) ‘Narrative cartography: From mapping stories to the narrative of maps and mapping’, *Cartographic Journal*, 51(2), pp. 101–106. Available at: https://doi.org/10.1179/0008704114Z.000000000130.

Chakravartty, P. and Ferreira, D. (2012) ‘Accumulation, Dispossession, and Debt: The Racial Logic of Global Capitalism — An Introduction’, *American Quarterly*, 64(3), pp. 361–385.

Charles, C.Z. (2006) *Won’t you be my neighbor? Race, class, and residence in Los Angeles*. New York: Russell Sage Foundation.

Chase, S.E. (2005) ‘Narrative Inquiry: Multiple Lenses, Approaches, Voices’, in N.K. Denzin and Y.S. Lincoln (eds) *The Sage Handbook of Qualitative Research*. Thousand Oaks: Sage Publications, Inc., pp. 651–679.

Christophers, B. (2011) ‘Revisiting the urbanization of capital’, *Annals of the Association of American Geographers*, 101(6), pp. 1347–1364. Available at: https://doi.org/10.1080/00045608.2011.583569.

Clandinin, D.J. and Connelly, F.M. (2000) *Narrative inquiry: experience and story in qualitative research*. San Francisco: Jossey-Bass, Inc.

Coates, T.-N. (2014) ‘The case for reparations’, *The Atlantic*. Available at: www.theatlantic.com/features/archive/2014/05/the-case-for-reparations/361631/.

Cohen, L. (1990) *Making a New Deal: Industrial Workers in Chicago, 1919-1939, Cambridge University Press*. Cambridge: Cambridge University Press.

Cohen, L. (2003) *A Consumers’ Republic: The Politics of Mass Consumption in Postwar America*. New York: Vintage Books.

Cooke, T. and Marchant, S. (2006) ‘The changing intrametropolitan location of high-poverty neighbourhoods in the US, 1990–2000’, *Urban Studies*, 43(11), pp. 1971–1989.

Cope, M. and Elwood, S. (2009) *Qualitative GIS: A Mixed Methods Approach*. Thousand Oaks: Sage Publications Ltd.

Cowen, D. and Lewis, N. (2017) ‘Revanchism and the racial state: Ferguson as “internal colony”’, in A. Albet and N. Benach (eds) *Gentrification as Global Strategy: Neil Smith and Beyond*. New York: Routledge, pp. 269–279.

Crampton, J.W. (2010) *Cartography: a critical introduction to cartography and GIS*. Hoboken: John Wiley & Sons, Ltd.

Crampton, J.W. and Krygier, J. (2006) ‘An introduction to critical cartography’, *ACME*, 4(1), pp. 11–33.

Cromley, G. (2017) ‘A Narrative Cartography of the French Indo-China War: A Journalistic Perspective’, *Cartographica*, 52(4), pp. 293–309. Available at: https://doi.org/10.3138/cart.52.4.3885.

Crossney, K. and Bartelt, D. (2005a) ‘Residential security, risk, and race: the Home Owners’ Loan Corporation and mortgage access in two cities’, *Urban Geography*, 26(8), pp. 707–736. Available at: https://doi.org/10.2747/0272-3638.26.8.707.

Crossney, K. and Bartelt, D. (2005b) ‘The legacy of the home owners’ loan corporation’, *Housing Policy Debate*, 16(3–4), pp. 547–574. Available at: https://doi.org/10.1080/10511482.2005.9521555.

Crowell, A.R. (2022) ‘Renting under racial capitalism: residential segregation and rent exploitation in the United States’, *Sociological Spectrum*, In press, pp. 1–24. Available at: https://doi.org/10.1080/02732173.2022.2068101.

Crump, J. *et al.* (2008) ‘Cities destroyed (again) for cash: forum on the U.S. foreclosure crisis’, *Urban Geography*, 29(8), pp. 745–784. Available at: https://doi.org/10.2747/0272-3638.29.8.745.

Cushing, L.J. *et al.* (2022) ‘Historical red-lining is associated with fossil fuel power plant siting and present-day inequalities in air pollutant emissions’, *Nature Energy* [Preprint]. Available at: https://doi.org/10.1038/s41560-022-01162-y.

Davern, M. *et al.* (2009) ‘Drawing Statistical Inferences from Historical Census Data, 1850–1950’, *Demography*, 46(3), p. 589. Available at: https://doi.org/10.1353/DEM.0.0062.

Dedman, B. (1988) ‘The color of money’, *Atlanta Journal-Constitution*, 1 May.

Del Casino, V.J. and Hanna, S.P. (2006) ‘Beyond the “Binaries”: A Methodological Intervention for Interrogating Maps as Representational Practices’, *ACME*, 4(1), pp. 34–56. Available at: https://doi.org/10.1002/9780470979587.ch13.

Dezember, R. and Rudegeair, P. (2019) ‘The future of housing rises in Phoenix’, *The Wall Street Journal*, 19 June. Available at: https://www.wsj.com/articles/the-future-of-housing-rises-in-phoenix-11560957036.

Dickerson, M. (2014) *Homeownership and America's financial underclass: Flawed premises, broken promises, new prescriptions*. New York: Cambridge University Press.

Dodge, M., Kitchin, R. and Perkins, C. (eds) (2009) *Rethinking maps: new frontiers in cartographic theory*. New York and London: Routledge.

Dorries, H., Hugill, D. and Tomiak, J. (2019) 'Racial capitalism and the production of settler colonial cities', *Geoforum*, 132, pp. 263–270. Available at: https://doi.org/10.1016/j.geoforum.2019.07.016.

Dreier, P., Mollenkopf, J. and Swanstrom, T. (2004) *Place Matters: Metropolitics for the Twenty-first Century*. Lawrence: University of Kansas Press.

DuBois, W.E.B. (1925) 'The challenge of Detroit', *The Crisis*. Available at: https://www.dareyoufight.org/Volumes/31/01/challenge_of_detroit.html.

Dymski, G.A. (2009) 'Racial exclusion and the political economy of the subprime crisis', *Historical Materialism*, 17, pp. 149–179. Available at: https://doi.org/10.1163/156920609X436162.

Eicher, C.L. and Brewer, C.A. (2001) 'Dasymetric mapping and areal interpolation: implementation and evaluation', *Cartography and Geographic Information Science*, 28(2), pp. 125–138. Available at: https://doi.org/10.1559/152304001782173727.

Elliott, J. (2005) *Using Narrative in Social Research: Qualitative and Quantitative Approaches*. Thousand Oaks: Sage Publications Ltd.

Endale, B. (2021) 'Home appraisal increased by almost $100,000 after Black family hid their race'. *USA Today*, 13 September. Available at: https://www.usatoday.com/story/money/nation-now/2021/09/13/home-appraisal-grew-almost-100-000-after-black-family-hid-their-race/8316884002/.

Faber, J.W. (2020) 'We built this: consequences of New Deal era intervention in America's racial geography', *American Sociological Review*, 85(5), pp. 739–775. Available at: https://doi.org/10.1177/0003122420948464.

Federal Housing Administration (1938) 'Underwriting manual: underwriting and valuation procedure under Title II of the National Housing Act'. Federal Housing Administration. Available at: https://www.huduser.gov/portal/sites/default/files/pdf/Federal-Housing-Administration-Underwriting-Manual.pdf.

Fields, D. and Raymond, E. (2021) 'Racialized geographies of housing financialization', *Progress in Human Geography*, 45(6), pp. 1625–1645. Available at: https://doi.org/10.1177/03091325211009299.

Fishback, P. *et al.* (2020) *Race, Risk, and the Emergence of Federal Redlining*. NBER.

Fishback, P. *et al.* (2021) *New evidence on redlining by federal housing programs in the 1930s, NBER Working Paper Series*. NBER.

Flippen, C. (2004) 'Unequal Returns to Housing Investments? A Study of Real Housing Appreciation among Black , White , and Hispanic Households "', *Social Forces*, 82, pp. 1523–1551.

Fortner, S.K. *et al.* (2021) 'An iterative course-based soil lead research and partnering model to address systemic racism and the enduring legacy of redlining', *Environmental Justice*, (In press). Available at: https://doi.org/10.1089/env.2021.0013.

Franzosi, R. (1998) 'Narrative analysis--or why (and how) sociologists should be interested in narrative', *Annual Review of Sociology*, 24, pp. 517–554.

Freund, D.M.P. (2007) *Colored property: state policy and white racial politics in suburban America*. Chicago: The University of Chicago Press.

Frey, W.H. (2015) *Census shows modest declines in black-white segregation*. Washington D.C.: Brookings Institutions. Available at: https://www.brookings.edu/blog/the-avenue/2015/12/08/census-shows-modest-declines-in-black-white-segregation/ (Accessed: 3 September 2020).

Fullilove, M.T. (2004) *Root Shock: How Tearing Up City Neighborhoods Hurts America, And What We Can Do About It*. New York: Ballantine Books.

Gandel, S. (2021) 'Zillow, facing big losses, quites flipping houses and will lay off a quarter of its staff', *The New York Times*, 2 November. Available at: https://www.nytimes.com/2021/11/02/business/zillow-q3-earnings-home-flipping-ibuying.html.

Gibbons, A. (2018) *City of Segregation: One Hundred Years of Struggle for Housing in Los Angeles*. Brooklyn: Verso.

Gilmore, R.W. (2002) 'Fatal Couplings of Power and Difference: Notes on Racism and Geography', *Professional Geographer*, 54(1), pp. 15–24. Available at: https://doi.org/10.1111/0033-0124.00310.

Glotzer, P. (2020) *How the Suburbs Were Segregated: Developers and the Business of Exclusionary Housing, 1890-1960*. New York: Columbia University Press.

Godoy, M. (2020) 'In U.S. cities, the health effects of past housing discrimination are plain to see', *NPR*, 19 November. Available at: https://www.npr.org/sections/health-shots/2020/11/19/911909187/in-u-s-cities-the-health-effects-of-past-housing-discrimination-are-plain-to-see (Accessed: 16 May 2022).

Goldberg, A.A. and Elenowitz, L. (1973) 'Maryland's housing insurance program-a forerunner for future state activity?', *Urban Law*, 5, pp. 524–536.

Gonzalez, D.J.X. *et al.* (2022) 'Historic redlining and the siting of oil and gas wells in the United States', *Journal of Exposure Science & Environmental Epidemiology 2022*, pp. 1–8. Available at: https://doi.org/10.1038/s41370-022-00434-9.

Goodchild, M.F. and Lam, N.S.-N. (1980) 'Areal interpolation: a variant of the traditional spatial approach', *Geo-Processing*, 1, pp. 297–312.

Gordon, C. (2008) *Mapping Decline: St. Louis and the Fate of the American City*. Philadelphia: University of Pennsylvania Press.

Gordon, M. (2019) 'Disruptive model takes on residential real estate', *Business Observer*, 1 November. Available at: https://www.businessobserverfl.com/news/2019/nov/01/disruptive-model-takes-on-residential-real-estate/.

Gotham, K.F. (2002) *Race, real estate, and uneven development: The Kansas City experience, 1900 - 2000*. Albany: State University of New York Press.

Gotham, K.F. (2009) 'Creating liquidity out of spatial fixity: The secondary circuit of capital and the subprime mortgage crisis', *International Journal of Urban and Regional Research*, 33(2), pp. 355–371. Available at: https://doi.org/10.1111/j.1468-2427.2009.00874.x.

Gotham, K.F. and Staples, W.G. (1996) 'Narrative analysis and the new historical sociology', *The Sociological Quarterly*, 37(3), pp. 481–501.

Greer, J. (2012) 'The Home Owners' Loan Corporation and the development of the Residential Security maps', *Journal of Urban History*, 39(2), pp. 275–296. Available at: https://doi.org/10.1177/0096144212436724.

Greer, J. (2014) 'Historic home mortgage redlining in Chicago', *Journal of the Illinois State Historical Society*, 107(2), pp. 204–233.

Greer, S. (1965) *Urban Renewal And American Cities*. Indianapolis: The Bobbs-Merrill Company.

Grove, M. *et al.* (2018) 'The legacy effect: understanding how segregation and environmental injustice unfold over time in Baltimore', *Annals of the American Association of Geographers*, 108(2), pp. 524–537. Available at: https://doi.org/10.1080/24694452.2017.1365585.

Hackworth, J. (2005) 'Emergent urban forms, or emergent post-modernisms? A comparison of large U.S. metropolitan areas', *Urban Geography*, 26(6), pp. 484–519. Available at: https://doi.org/10.2747/0272-3638.26.6.484.

Hackworth, J. (2007) *The Neoliberal City: Governance, Ideology, and Development in American Urbanism*. Ithaca: Cornell University Press.

Hackworth, J. (2016) ‘Why there is no Detroit in Canada’, *Urban Geography*, 37(2), pp. 272–295. Available at: https://doi.org/10.1080/02723638.2015.1101249.

Hackworth, J. (2019) *Manufacturing Decline: How Racism and the Conservative Movement Crush the American Rust Belt*. New York: Columbia University Press.

Hammer, R.B. *et al.* (2004) ‘Characterizing dynamic spatial and temporal residential density patterns from 1940–1990 across the North Central United States’, *Landscape and Urban Planning*, 69, pp. 183–199. Available at: https://doi.org/10.1016/j.landurbplan.2003.08.011.

Hankins, K. and Holloway, S. (2020) ‘Suburbanization and the Making of Atlanta as the “Black Mecca”’, in J. Nijman (ed.) *The Life of North American Suburbs*. Toronto: University of Toronto Press.

Harley, J.B. (1989) ‘Deconstructing the map’, *Cartographica*, 26(2), pp. 1–20.

Harris, D. (2010) *Second suburb: Levittown, Pennsylvania*. Pittsburgh: University of Pittsburgh Press.

Harris, R. (2012) ‘“Ragged urchins play on marquetry floors”: The discourse of filtering is reconstructed, 1920s-1950s’, *Housing Policy Debate*, 22(3), pp. 463–482. Available at: https://doi.org/10.1080/10511482.2012.680481.

Harriss, C.L. (1951) *History and policies of the Home Owners’ Loan Corporation*. New York: NBER Books.

Harvey, D. (1978) ‘The urban process under capitalim: a framework for analysis’, *International Journal of Urban and Regional Research*, 2(1–3), pp. 101–131.

Harvey, D. (1981) ‘The spatial fix - Hegel, von Thunen, and Marx’, *Antipode*, 13(3), pp. 1–12.

Harvey, D. (1982) *The limits to capital*. Chicago: University of Chicago Press.

Harvey, D. (2003) *The new imperialism*. Oxford: Oxford University Press. Available at: https://eatonak.org/IPE501/downloads/files/New%20Imperialism.pdf.

Harvey, D. (2017) *Marx, Capital, and the Madness of Economic Reason*. Oxford: Oxford University Press.

Hauer, M.E. (2019) ‘Population projections for U.S. counties by age, sex, and race controlled to shared socioeconomic pathway’, *Scientific Data*, 6, p. 190005. Available at: https://doi.org/10.1038/sdata.2019.5.

Hauer, M.E., Evans, J.M. and Mishra, D.R. (2016) 'Millions projected to be at risk from sea-level rise in the continental United States', *Nature Climate Change*, 6(7), pp. 691–695. Available at: https://doi.org/10.1038/nclimate2961.

Helper, R. (1969) *Racial policies and practices of real estate brokers*. Minneapolis: University of Minnesota Press.

Henry, S. (2016) 'The lost communities: a preservation group unearths Buckhead's African American history', *Atlanta Magazine*, 12 April. Available at: https://www.atlantamagazine.com/news-culture-articles/the-lost-communities-a-preservation-group-unearths-buckheads-african-american-history/.

Hernandez, J. (2009) 'Redlining revisited: mortgage lending patterns in Sacramento 1930-2004', *International Journal of Urban and Regional Research*, 33(2), pp. 291–313. Available at: https://doi.org/10.1111/j.1468-2427.2009.00873.x.

Hillier, A.E. (2002) 'Redlining in Philadelphia', in A.K. Knowles (ed.) *Past Time, Past Place: GIS for History*. La Vergne, TN: Ingram Publisher Services, pp. 79–91.

Hillier, A.E. (2003a) 'Redlining and the Home Owners' Loan Corporation', *Urban History*, 29(4), pp. 394–420. Available at: https://doi.org/10.1177/0096144203252003.

Hillier, A.E. (2003b) 'Who received loans? Home owners' loan corporation lending and discrimination in Philadelphia in the 1930s', *Journal Of Planning History*, 2(1), pp. 3–24. Available at: https://doi.org/10.1177/1538513202239694.

Hillier, A.E. (2005a) 'Residential security maps and neighborhood appraisals: the Home Owners' Loan Corporation and the Case of Philadelphia', *Social Science History*, 29(2), pp. 207–233.

Hillier, A.E. (2005b) 'Searching for red lines: spatial analysis of lending patterns in Philadelphia, 1940 - 1960', *Pennsylvania History: A Journal of Mid-Atlantic Studies2*, 72(1), pp. 25–47.

Hinchman, L.P. and Hinchman, S. (1997) 'Introduction', in L.P. Hinchman and S. Hinchman (eds) *Memory, Identity, Community: The Idea of Narrative in the Human Sciences*. Albany: State University of New York Press, pp. xiii–xxxii.

Hirsch, A.R. (1983) *Making The Second Ghetto: Race And Housing In Chicago, 1940-1960*. Cambridge: Cambridge University Press.

Hobson, M.J. (2017) *The Legend of Black Mecca: Politics and Class in the Making of Modern Atlanta*. Chapel Hill: The University of North Carolina Press.

Hoffman, J.S., Shandas, V. and Pendleton, N. (2020) 'The effects of historical housing policies on resident exposure to intra-urban heat: a study of 108 US urban areas', *Climate*, 8(1), pp. 1–15. Available at: https://doi.org/10.3390/cli8010012.

Holloway, S.R. and Wyly, E.K. (2001) '"The Color of Money" expanded: geographically contingent mortgage lending in Atlanta', *Journal of Housing Research*, 12(1), pp. 55–90.

Hornstein, J.M. (2005) *A Nation of Realtors: A Cultural History of the Twentieth-Century American Middle Class*. Durham: Duke University Press.

Howell, J. and Korver-Glenn, E. (2018) 'Neighborhoods, Race, and the Twenty-first-century Housing Appraisal Industry', *Sociology of Race and Ethnicity*, 4(4), pp. 473–490. Available at: https://doi.org/10.1177/2332649218755178.

Howell, J. and Korver-Glenn, E. (2021) 'The Increasing Effect of Neighborhood Racial Composition on Housing Values, 1980-2015', *Social Problems*, 68(4), pp. 1051–1071. Available at: https://doi.org/10.1093/socpro/spaa033.

Howell, O. (2015) *Making the Mission: Planning and Ethnicity in San Francisco*. Chicago: The University of Chicago Press.

Hoyt, H. (1933) *One hundred years of land values in Chicago: the relationship of the growth of Chicago to the rise of its land values, 1830-1933*. Chicago: University of Chicago Press.

Hoyt, H. (1939) *The Structure and Growth of Residential Neighborhoods in American Cities*. Washington: United States Government Printing Office.

Huang, S.J. and Sehgal, N.J. (2022) 'Association of historic redlining and present-day health in Baltimore', *PLOS ONE*, 17(1), p. e0261028.

Huggins, J.C. (2015) 'A Cartographic Perspective on the Correlation Between Redlining and Public Health in Austin, Texas–1951', *Cityscape*, 19(2), pp. 267–280. Available at: https://doi.org/10.2307/26328340.

Hunter, M.A. and Robinson, Z.F. (2018) *Chocolate cities: the Black map of American life*. Berkeley: University of California Press.

Hyndman, R.J. and Koehler, A.B. (2006) 'Another look at measures of forecast accuracy', *International Journal of Forecasting*, 22(4), pp. 679–688. Available at: https://doi.org/10.1016/J.IJFORECAST.2006.03.001.

Imbroscio, D. (2021) 'Race matters (even more than you already think): Racism, housing, and the limits of The Color of Law', *Journal of Race, Ethnicity and the City*, 2(1), pp. 29–53. Available at: https://doi.org/10.1080/26884674.2020.1825023.

Immergluck, D. (2009) *Foreclosed: High-risk lending, deregulation, and the undermining of America's mortgage markets*. Ithaca: Cornell University Press.

Jackson, K.T. (1980) ‘Race, ethnicity, and real estate appraisal: The Home Owners Loan Corporation and the Federal Housing Administration’, *Journal of Urban History*, 6(4), pp. 419–452. Available at: https://doi.org/10.1177/009614428000600404.

Jackson, K.T. (1985) *Crabgrass frontier: the suburbanization of the United States*. Oxford: Oxford University Press.

Jacoby, S.F. *et al.* (2018) ‘The enduring impact of historical and structural racism on urban violence in Philadelphia’, *Social Science & Medicine*, 199, pp. 87–95. Available at: https://doi.org/10.1016/j.socscimed.2017.05.038.

Jan, T. (2018) ‘Redlining was banned 50 years ago. It’s still hurting minorities today’, *The Washington Post*, 28 March. Available at: https://www.washingtonpost.com/news/wonk/wp/2018/03/28/redlining-was-banned-50-years-ago-its-still-hurting-minorities-today/ (Accessed: 23 May 2022).

Jenkins, D. (2021) *The Bonds of Inequality: Debt and the Making of the American City*. Chicago: The University of Chicago Press. Available at: https://www.ebsco.com/terms-of-use.

Johns, J., Robinson, L., and Chavez, N. (2021) 'A Black couple had a white friend show their home and its appraisal rose by nearly half a million dollars'. *CNN*, 9 December. Available at: https://www.cnn.com/2021/12/09/business/black-homeowners-appraisal-discrimination-lawsuit/index.html.

Jones, P. (2009) *The Selma of the North: civil rights insurgency in Milwaukee*. Boston: Harvard University Press.

Kamin, D. (2022) 'Home appraised with a Black owner: $472,000. With a white owner: $750,000'. *The New York Times*, 18 August. Available at: https://www.nytimes.com/2022/08/18/realestate/housing-discrimination-maryland.html.

Kass, A., Crosby, A. and Parker, B. (2022) ‘A vicious cycle: Fiscal intervention, pension underfunding, and instability in (re)making racialized geographies’, *Environment and Planning A* [Preprint]. Available at: https://doi.org/10.1177/0308518X221084995.

Keating, L. and Flores, C.A. (2000) ‘Sixty and out: Techwood Homes transformed by enemies and friends’, *Journal of Urban History*, 26(3), pp. 275–311. Available at: https://doi.org/10.1177/009614420002600301.

Kelly, M.T. (2022) ‘Land Speculation and Suburban Covenants: Racial Capitalism and the Pre-Redlining Roots of Housing Segregation in Syracuse, New York’, *Antipode* [Preprint]. Available at: https://doi.org/10.1111/anti.12845.

Kiger, P.J. (2021) ‘Flip flop: why Zillow’s algorithmic home buying venture imploded’, *Insights by Stanford Business*, 9 December. Available at:

https://www.gsb.stanford.edu/insights/flip-flop-why-zillows-algorithmic-home-buying-venture-imploded.

Kitchin, R. and Dodge, M. (2007) 'Rethinking maps', *Progress in Human Geography*, 31(3), pp. 331–344. Available at: https://doi.org/10.1177/0309132507077082.

Krimmel, J. (2017) 'Persistence of Prejudice: Estimating the Long Term Effects of Redlining', *Working Paper* [Preprint], (October 2016).

Kruse, K.M. (2005) *White flight: Atlanta and the making of modern conservatism*. Princeton: Princeton University Press.

Krysan, M. and Crowder, K. (2017) *Cycle of Segregation: Social Processes and Residential Stratification*. New York: Russell Sage Foundation.

Kwan, M. (2002) 'Feminist Visualization: Re-envisioning GIS as a Method in Feminist Geographic Research', *Annals of the Association of American Geographers*, 92(4), pp. 645–661. Available at: https://doi.org/10.1111/1467-8306.00309.

Kwan, M.-P. and Ding, G. (2008) 'Geo-Narrative: Extending Geographic Information Systems for Narrative Analysis in Qualitative and Mixed-Method Research', *The Professional Geographer*, 60(4), pp. 443–465. Available at: https://doi.org/10.1080/00330120802211752.

Labov, W. (1972) 'The transformation of experience in narrative syntax', in *Language in the inner city: studies in the Black English Vernacular*. Philadelphia: University of Pennsylvania Press, pp. 354–396.

Lands, L. (2009) *The culture of property: race, class, and housing landscapes in Atlanta, 1880-1950*. Athens: University of Georgia Press.

Lane, H.M. *et al.* (2022) 'Historical redlining is associated with present-day air pollution disparities in U.S. cities', *Environmental Science & Technology Letters*, p. A-F. Available at: https://doi.org/10.1021/acs.estlett.1c01012.

Langford, M. (2006) 'Obtaining population estimates in non-census reporting zones: An evaluation of the 3-class dasymetric method', *Computers, Environment and Urban Systems*, 30, pp. 161–180. Available at: https://doi.org/10.1016/j.compenvurbsys.2004.07.001.

Lee, E.K. *et al.* (2022) 'Health outcomes in redlined versus non-redlined neighborhoods: A systematic review and meta-analysis', *Social Science & Medicine*, 294, p. 114696. Available at: https://doi.org/10.1016/J.SOCSCIMED.2021.114696.

Lee, T. (2019) 'A vast wealth gap, driven by segregation, redlining, evictions and exclusion, separates black and white America', *The New York Times Magazine*, 14

August. Available at: https://www.nytimes.com/interactive/2019/08/14/magazine/racial-wealth-gap.html (Accessed: 3 March 2022).

Lefebvre, H. (1970) *The Urban Revolution*. Minneapolis: The University of Minnesota Press.

Levine, M.V. (2020) *The State of Black Milwaukee in national perspective: racial inequality in the nation's 50 largest metropolitan areas*. Milwaukee: University of Wisconsin - Milwaukee.

Leyk, S. and Uhl, J.H. (2018) 'HISDAC-US, historical settlement data compilation for the conterminous United States over 200 years', *Scientific Data*, 5, p. 180175.

Li, M. and Yuan, F. (2022) 'Historical redlining and food environments: A study of 102 urban areas in the United States', *Health & Place*, 75, p. 102775. Available at: https://doi.org/10.1016/j.healthplace.2022.102775.

Light, J.S. (2010) 'Nationality and neighborhood risk at the origins of FHA underwriting', *Journal of Urban History*, 36(5), pp. 634–671. Available at: https://doi.org/10.1177/0096144210365677.

Lipsitz, G. (2006) *The Possessive Investment in Whiteness: How White People Profit from Identity Politics*. Philadelphia: Temple University Press.

Lipsitz, G. (2011) *How racism takes place*. Philadelphia: Temple University Press.

Locke, D.H. *et al.* (2021) 'Residential housing segregation and urban tree canopy in 37 US Cities', *npj Urban Sustainability 2021 1:1*, 1(1), pp. 1–9. Available at: https://doi.org/10.1038/s42949-021-00022-0.

Logan, J.R. *et al.* (2021) 'Improving estimates of neighborhood change with constant tract boundaries', *Applied Geography*, 132, p. 102476. Available at: https://doi.org/10.1016/j.apgeog.2021.102476.

Logan, J.R., Stults, B.J. and Xu, Z. (2016) 'Validating population estimates for harmonized census tract data, 2000–2010', *Annals of the American Association of Geographers*, 106(5), pp. 1013–1029. Available at: https://doi.org/10.1080/24694452.2016.1187060.

Logan, J.R., Xu, Z. and Stults, B.J. (2014) 'Interpolating U.S. decennial census tract data from as early as 1970 to 2010: a longitudinal tract database', *The Professional Geographer*, 66(3), pp. 412–420.

Loyd, J.M. and Bonds, A. (2018) 'Where do Black Lives Matter? Race, stigma, and place in Milwaukee, Wisconsin', *Sociological Review*, 66(4), pp. 898–918.

Mai, G. *et al.* (2022) 'Narrative Cartography with Knowledge Graphs', *Journal of Geovisualization and Spatial Analysis*, 6(1). Available at: https://doi.org/10.1007/s41651-021-00097-4.

Manson, S. *et al.* (2021) *IPUMS National Historical Geographic Information System, IPUMS*. Minneapolis: IPUMS. Available at: http://doi.org/10.18128/D050.V16.0.

Marable, M. (2015) *How Capitalism Underdeveloped Black America: Problems in Race, Political Economy, and Society*. Second edition. Chicago: Haymarket Books.

Marchiel, R.K. (2020) *After Redlining: The Urban Reinvestment Movement in the Era of Financial Deregulation*. Chicago: The University of Chicago Press.

Markley, S. (2018) 'Suburban gentrification? Examining the geographies of new urbanism in Atlanta's inner suburbs', *Urban Geography*, 39(4), pp. 606–630.

Markley, S. (2023) 'Tabulating Home Owners' Loan Corporation area description sheet data', *Environment and Planning B: Urban Analytics and City Science*, 50(1), pp. 268–280. Available at: https://doi.org/10.1177/23998083221133112.

Markley, S.N. *et al.* (2020) 'The limits of homeownership: racial capitalism, Black wealth, and the appreciation gap in Atlanta', *International Journal of Urban and Regional Research*, 44(2), pp. 310–328. Available at: https://doi.org/10.1111/1468-2427.12873.

Markley, S.N. *et al.* (2022a) *HHUUD10: Historical Housing Unit and Urbanization Database v2010, Open Science Framework*. Available at: https://doi.org/10.17605/OSF.IO/FZV5E.

Markley, S.N. *et al.* (2022b) 'Housing unit and urbanization estimates for the continental U.S. in consistent tract boundaries, 1940–2019', *Scientific Data*, 9(1). Available at: https://doi.org/10.1038/S41597-022-01184-X.

Marx, K. (1867) *Capital: a critique of political economy*. Penguin Random House.

Marx, K. (1973) *Grundrisse*. Available at: http://www.marxists.org/archive/marx/works/1857/grundrisse/index.html.

Massey, D.S. and Denton, N.A. (1993) *American apartheid: segregation and the making of the underclass*. Cambridge: Harvard University Press.

McCabe, B.J. (2016) *No place like home: Wealth, community & the politics of homeownership*. New York: Oxford University Press.

McClintock, N. (2011) 'From industrial garden to food desert', in A.H. Alkon and J. Agyemon (eds) *Cultivating Food Justice: Race, Class, and Sustainability*. Cambridge: MIT Press, pp. 89–120.

McClintock, N. (2018) ‘Cultivating (a) Sustainability Capital: Urban Agriculture, Ecogentrification, and the Uneven Valorization of Social Reproduction’, *Annals of the American Association of Geographers*, 108(2), pp. 579–590. Available at: https://doi.org/10.1080/24694452.2017.1365582.

McKittrick, K. (2006) *Demonic Grounds: Black Women and the Cartographies of Struggle*. Minneapolis: University of Minnesota Press.

McKittrick, K. (2013) ‘Plantation Futures’, *Small Axe*, 17(3), pp. 1–15. Available at: https://doi.org/10.1215/07990537-2378892.

McWhorter, J. (2021) ‘Racism, redlining and police shootings’, *The New York Times*, 28 September. Available at: https://www.nytimes.com/2021/09/28/opinion/redlining-systemic-racism.html (Accessed: 16 May 2022).

Melamed, J. (2015) ‘Racial Capitalism’, *Critical Ethnic Studies*, 1(1), pp. 76–85.

Mennis, J. (2003) ‘Generating surface models of population using dasymetric mapping’, *The Professional Geographer*, 55(1), pp. 31–42.

Mennis, J. (2009) ‘Dasymetric mapping for estimating population in small areas’, *Geography Compass*, 3(2), pp. 727–745.

Michney, T.M. (2022) ‘How the City Survey’s redlining maps were made: a closer look at HOLC’s Mortgage Rehabilitation division’, *Journal of Planning History*, 21(4), pp. 316–344. Available at: https://doi.org/10.1177/15385132211013361.

Michney, T.M. and Winling, L. (2020) ‘New perspectives on New Deal housing policy: explicating and mapping HOLC loans to African Americans’, *Journal of Urban History*, 46(1), pp. 150–180. Available at: https://doi.org/10.1177/0096144218819429.

Minde, J. (2015) ‘Exploring the Potential for Narrative Analysis in Maps : The Case Study of the Georgia-South Ossetia Conflict’, *Conflict and Narrative: Explorations in Theory and Practice*, 2(1), pp. 19–33.

Mitchell, J. and Chihaya, G.K. (2022) ‘Tract level associations between historical residential redlining and contemporary fatal encounters with police’, *Social Science & Medicine*, 302, p. 114989. Available at: https://doi.org/10.1016/J.SOCSCIMED.2022.114989.

Morgan-Fleming, B., Riegle, S. and Fryer, W. (2007) ‘Narrative Inquiry in Archival Work’, in D.J. Clandinin (ed.) *Handbook of Narrative Inquiry: Mapping a Methodology*. Thousand Oaks: Sage Publications, Inc., pp. 81–98.

Moritz, S. and Bartz-Beielstein, T. (2017) ‘imputeTS: time series missing value imputation in R’, *The R Journal*, 9(1), pp. 207–218.

Moura, M.C.P., Smith, S.J. and Belzer, D.B. (2015) '20 Years of U.S. residential housing stock and floor space', *PLoS ONE*, 10(8), p. e0134135. Available at: https://doi.org/10.1371/journal.pone.0134135.

Moxley, D. and Fischer, B. (2020) 'Historic HOLC redlining in Indianapolis and the legacy of environmental impacts', *Journal of Public and Environmental Affairs*, 1(1), pp. 1–8.

Nakagaki, N. *et al.* (2010) *Enhanced National Land Cover Data 1992 (NCLDe 92), U.S. Geological Survey*. Reston, VA: US Geological Survey. Available at: https://water.usgs.gov/lookup/getspatial?nlcde92.

Napton, D.E. and Laingen, C.R. (2008) 'Expansion of golf courses in the United States', *Geographical Review*, 98(1), pp. 24–41.

National Association of Real Estate Boards (1924) 'Code of Ethics'.

Nelson, G.D. (2021) 'Redlining, race, and the Color of Money', *Dissent*. Available at: https://www.dissentmagazine.org/online_articles/redlining-race-and-the-color-of-money.

Nelson, R.K. *et al.* (2022) *Mapping Inequality, American Panorama*. Available at: https://dsl.richmond.edu/panorama/redlining/.

Nelson, R.K. and Ayers, E.L. (2021) *Renewing inequality, American Panorama*. Richmond: Digital Scholarship Lab. Available at: https://dsl.richmond.edu/panorama/renewal/.

Newman, K. and Wyly, E.K. (2004) 'Geographies of mortgage market segmentation: the case of Essex County, New Jersey', *Housing Studies*, 19(1), pp. 53–83. Available at: https://doi.org/10.1080/0267303042000152177.

Nicolaides, B.M. (2002) *My blue heaven: Life and politics in the working-class suburbs of Los Angeles, 1920 - 1965*. Chicago: University of Chicago Press.

Nightingale, C.H. (2012) *Segregation: A Global History of Divided Cities*. Chicago: University of Chicago Press.

NYU (2020) 'Ta-Nehisis Coates' "The case for reparations" named top work of journalism of the last decade', *New York University*, 14 October. Available at: https://www.nyu.edu/about/news-publications/news/2020/october/ta-nehisi-coates---the-case-for-reparations--named-top-work-of-j.html.

Oliver, M.L. and Shapiro, T. (1995) *Black wealth, white wealth*. New York: Routledge.

Park, R.E. and Burgess, E.W. (1925) *The city*. Chicago: The University of Chicago Press.

Parker, W. (2022) ‘Zillow’s shuttered home-flipping business lost $881 million in 2021’, *The Wall Street Journal*, 10 February. Available at: https://www.wsj.com/articles/zillows-shuttered-home-flipping-business-lost-881-million-in-2021-11644529656.

Perry, A., Rothwell, J. and Harshbarger, D. (2018) ‘The devaluation of assets in black neighborhoods: the case of residential property’, (November).

Perry, A.M. (2020) *Know Your Price: Valuing Black Lives and Property in America’s Black Cities*. Washington DC: The Brookings Institution.

Philpott, T.L. (1978) *The Slum and the Ghetto: Neighborhood Deterioration and Middle-Class Reform, Chicago 1880-1930*. New York: Oxford University Press.

Pogge, J. (1992) ‘Reinvestment in Chicago neighborhoods: a twenty-year struggle’, in G.D. Squires (ed.) *From Redlining to Reinvestment: Community Responses to Urban Disinvestment*. Philadelphia: Temple University Press, pp. 133–148.

Ponder, C.S. (2021) ‘Spatializing the Municipal Bond Market: Urban Resilience under Racial Capitalism’, *Annals of the American Association of Geographers*, 111(7), pp. 2112–2129. Available at: https://doi.org/10.1080/24694452.2020.1866487.

Popovich, N. and Palmer, B. (2020) ‘How decades of racist housing policy left neighborhoods sweltering’, *The New York Times*, 24 August. Available at: https://www.nytimes.com/interactive/2020/08/24/climate/racism-redlining-cities-global-warming.html (Accessed: 16 May 2022).

Pulido, L. (2016) ‘Flint, environmental racism, and racial capitalism’, *Capitalism, Nature, Socialism*, 27(3), pp. 1–16. Available at: https://doi.org/10.1080/10455752.2016.1213013.

Pulido, L. (2017) ‘Geographies of race and ethnicity II: environmental racism, racial capitalism and state-sanctioned violence’, *Progress in Human Geography*, 41(4), pp. 524–533. Available at: https://doi.org/10.1177/0309132516646495.

Purifoy, D.M. and Seamster, L. (2021) ‘Creative extraction: Black towns in white space’, *Environment and Planning D: Society and Space*, 39(1), pp. 47–66. Available at: https://doi.org/10.1177/0263775820968563.

Robinson, C. (2000) *Black Marxism: The making of the black radical tradition*. Second edition. Chapel Hill: University of North Carolina Press.

Rockett, D. (2020) ‘Discrimination Against Black Homebuyers Persists. Here’s How One Northwestern Grad and Housing Expert Wants to Fix It.’, *Chicago Trubune*, 28 January. Available at: https://www.chicagotribune.com/real-estate/ct-re-race-for-profit-keeanga-yamahtta-taylor-20200124-20200128-ohxu2vohjbeobf73ri2jbv4gyq-story.html.

Rodriguez, A.D. (2021) *Diverging space for deviants: the politics of Atlanta's public housing*. Athens, GA: University of Georgia Press.

Roediger, D.R. (2005) *Working toward Whiteness: How America's immigrants became White: the strange journey from Ellis Island to the suburbs*. New York: Basic Books.

Romem, I. (2016) *Has the expansion of American cities slowed down?*, *Buildzoom*. Available at: https://www.buildzoom.com/blog/cities-expansion-slowing.

Rose, H.M. (1971) *The Black Ghetto: A Spatial Behavioral Perspective*. New York: McGraw-Hill.

Rose, J.D. (2011) 'The Incredible HOLC? Mortgage Relief During the Great Depression', *Journal of Money, Credit and Banking*, 43(6), pp. 1073–1107.

Rothstein, R. (2017) *The color of law: a forgotten history of how our government segregated America*. New York: Liveright.

Rubinowitz, L.S. and Trosman, E. (1979) 'Affirmative action and the American Dream: implementing fair housing policies in federal homeownership programs', *Northwestern University Law Review*, 74(4).

Rucks-Ahidiana, Z. (2021) 'Theorizing Gentrification as a Process of Racial Capitalism', *City and Community* [Preprint]. Available at: https://doi.org/10.1177/15356841211054790.

Ruggles, S. *et al.* (2011) 'Frozen film and FOSDIC forms: Restoring the 1960 U.S. Census of population and housing', *Historical Methods*, 44(2), pp. 69–78. Available at: https://doi.org/10.1080/01615440.2011.561778.

Rutan, D.Q. and Glass, M.R. (2018) 'The lingering effects of neighborhood appraisal: Evaluating redlining's legacy in Pittsburgh', *The Professional Geographer*, 70(3), pp. 339–349. Available at: https://doi.org/10.1080/00330124.2017.1371610.

Ruther, M., Leyk, S. and Buttenfield, B.P. (2015) 'Comparing the effects of an NLCD-derived dasymetric refinement on estimation accuracies for multiple areal interpolation methods', *GIScience & Remote Sensing*, 52(2), pp. 158–178. Available at: https://doi.org/10.1080/15481603.2015.1018856.

Ryan, M.-L., Foote, K. and Azaryahu, M. (2016) *Narrating Space/Spatializing Narrative: Where Narrative Theory and Geography Meet*. Columbus, OH: The Ohio State University Press.

Satter, B. (2009) *Family properties: Race, real estate, and the exploitation of black urban America*. Basingstoke, UK: Macmillan.

Schinasi, L.H. *et al.* (2022) 'Associations between historical redlining and present-day heat vulnerability housing and land cover characteristics in Philadelphia, PA', *Journal of Urban Health*, 99(1), pp. 134–145. Available at: https://doi.org/10.1007/S11524-021-00602-6/FIGURES/2.

Schroeder, J.P. (2007) 'Target-density weighting interpolation and uncertainty evaluation for temporal analysis of census data', *Geographical Analysis*, 39, pp. 311–335.

Schroeder, J.P. (2017) 'Hybrid areal interpolation of census counts from 2000 blocks to 2010 geographies', *Computers, Environment and Urban Systems*, 62, pp. 53–63. Available at: https://doi.org/10.1016/j.compenvurbsys.2016.10.001.

Schroeder, J.P. and Van Riper, D.C. (2013) 'Because Muncie's densities are not Manhattan's: using geographical weighting in the expectation-maximization algorithm for areal interpolation', *Geographical Analysis*, 45, pp. 216–237. Available at: https://doi.org/10.1111/gean.12014.

Schwartz, E. *et al.* (2021) 'The legacy of redlining: Associations between historical neighborhood mapping and contemporary tobacco retailer density in Ohio', *Health & Place*, 68, p. 102529. Available at: https://doi.org/10.1016/J.HEALTHPLACE.2021.102529.

Seamster, L. and Purifoy, D. (2021) 'What is environmental racism for? Place-based harm and relational development', *https://doi.org/10.1080/23251042.2020.1790331*, 7(2), pp. 110–121. Available at: https://doi.org/10.1080/23251042.2020.1790331.

Self, R.O. (2003) *American Babylon: Race and the struggle for postwar Oakland*. Princeton: Princeton University Press.

Sherman, E. (2022) 'What Zillow's failed algorithm means for the future of data science', *Fortune Education*, 1 February. Available at: https://fortune.com/education/articles/what-zillows-failed-algorithm-means-for-the-future-of-data-science/.

Skinner, B., Levy, H. and Burtch, T. (2021) *Digital redlining: the relevance of 20th century housing policy to 21st century broadband access and education*. Annenberg Institute at Brown University. Available at: https://doi.org/doi.org/10.26300/q9av-9c93.

Smith, C.P. (2000) 'Content analysis and narrative analysis', in T. Reis and C. Judd (eds) *Handbook of Research Methods in Social and Personality Psychology*. Cambridge: Cambridge University Press, pp. 313–335.

Smith, N. (1984) *Uneven Development: Nature, Capital, and the Production of Space*. Oxford: Basil Blackwell.

Smith, N. (1998) 'Giuliani time: the revanchist 1990s', *Social Text*, 57(Winter), pp. 1–20.

Snow, M.S. (2011) *Delivering what users want: the evolution of Census Bureau small area data, U.S. Census Bureau*. US Census Bureau.

Souto-Manning, M. (2014) 'Critical narrative analysis: the interplay of critical discourse and narrative analyses', *International Journal of Qualitative Studies Education*, 27(2), pp. 159–180. Available at: https://doi.org/10.1080/09518398.2012.737046.

Squires, G.D. (1992a) 'Community reinvestment: an emerging social movement', in G.D. Squires (ed.) *From Redlining to Reinvestment: Community Responses to Urban Disinvestment*. Philadelphia: Temple University Press, pp. 1–37.

Squires, G.D. (1992b) *From Redlining to Reinvestment: Community Responses to Urban Disinvestment*. Edited by G.D. Squires. Philadelphia: Temple University Press.

Staley, D.J. (2007) 'Finding narratives of space and time', in D.S. Stinton and J.J. Lund (eds) *Understanding place: GIS and mapping across the curriculum*. Redlands: ESRI Press, pp. 35–48.

Stone, C. (1989) *Regime Politics: Governing Atlanta, 1946-1988*. Lawrence, KS: University Press of Kansas.

Stuart, G. (2003) *Discriminating risk: the US mortgage lending industry in the twentieth century*. Ithaca: Cornell University Press.

Sugrue, T.J. (1996) *The origins of the urban crisis: Race and inequality in postwar Detroit*. Princeton: Princeton University Press.

Swope, C.B., Hernández, D. and Cushing, L.J. (2022) 'The Relationship of Historical Redlining with Present-Day Neighborhood Environmental and Health Outcomes: A Scoping Review and Conceptual Model', *Journal of Urban Health* [Preprint]. Available at: https://doi.org/10.1007/s11524-022-00665-z.

Talen, E. (2014) 'Housing demolition during urban renewal', *City & Community*, 13(3), pp. 233–253. Available at: https://doi.org/10.1111/cico.12070.

Taylor, K.-Y. (2019) *Race for Profit: How Banks and the Real Estate Industry Undermined Black Homeownership*. Chapel Hill: The University of North Carolina Press.

Teaford, J.C. (1990) *The Rough Road To Renaissance: Urban Revitalization In America, 1940-1985*. Baltimore: The Johns Hopkins University Press.

Teresa, B.F. (2022a) 'Planners' alchemy achieved? How NIMBY and YIMBY reproduce the housing question', *International Journal of Urban and Regional Research*, 46(2), pp. 307–311. Available at: https://doi.org/10.1111/1468-2427.13065.

Teresa, B.F. (2022b) ‘The reemergence of land contracts in Chicago: Racialized class-monopoly rent as a recursive objective in capitalist property markets’, *Geoforum*, 130, pp. 35–45. Available at: https://doi.org/10.1016/j.geoforum.2022.02.004.

Thebault, R. (2018) ‘Fresno’s Mason-Dixon Line’, *The Atlantic*, 20 August. Available at: https://www.theatlantic.com/politics/archive/2018/08/fresnos-segregation/567299/ (Accessed: 16 May 2022).

Trotter Jr., J.W. (1985) *Black Milwaukee: The Making of an Industrial Proletariat, 1915-45*. Urbana and Chicago: University of Illinois Press.

Trounstine, J. (2018) *Segregation by Design: Local Politics and Inequality in American Cities*. Cambridge, UK: Cambridge University Press.

Uhl, J.H. *et al.* (2021) ‘A century of decoupling size and structure of urban spaces in the United States’, *Communications Earth & Environment* [Preprint]. Available at: https://doi.org/10.1038/s43247-020-00082-7.

US Census Bureau (2018) ‘Census tracts for the 2020 census-final criteria’. Federal Register. Available at: https://www.federalregister.gov/documents/2018/11/13/2018-24567/census-tracts-for-the-2020-census-final-criteria.

Walker, R.A. (1981) ‘A theory of suburbanization: Capitalism and the construction of urban space in the United States’, in M. Dear and A.J. Scott (eds) *Urbanization and urban planning in capitalist society*. London and New York: Methuen, pp. 383–429.

Warren, E. (2021) *S. 1368*. Washington DC: United States Senate.

Weiss, M.A. (1989) ‘Richard T. Ely and the contribution of economic research to national housing policy, 1920 - 1940’, *Urban Studies*, 26, pp. 115–126.

Wiese, A. (2004) *Places of their own: African American suburbanization in the twentieth century*. University of Chicago Press.

Wilkerson, I. (2010) *The Warmth of Other Suns: The Epic Story of America’s Great Migration*. New York: Vintage.

Wilson, B. (2020) ‘Urban heat management and the legacy of redlining’, *Journal of the American Planning Association*, 86(4), pp. 443–457. Available at: https://doi.org/10.1080/01944363.2020.1759127.

Wilson, B.M. (2000) *America’ s Johannesburg: industrialization and racial transformation in Birmingham*. New York: Rowman & Littlefield.

Winling, L.C. and Michney, T.M. (2021) ‘The roots of redlining: academic, governmental, and professional networks in the making of the New Deal lending regime’,

Journal of American History, pp. 42–69. Available at: https://doi.org/10.1093/jahist/jaab066.

Wood, D. (1992) *The power of maps*. New York and London: The Guilford Press.

Woods, C. (2017) *Development Arrested: The Blues and Plantation Power in the Mississippi Delta*. Brooklyn: Verso.

Woods, L.L. (2012) 'The federal home loan bank board, redlining, and the national proliferation of racial lending discrimination, 1921-1950', *Journal of Urban History*, 38(6), pp. 1036–1059. Available at: https://doi.org/10.1177/0096144211435126.

Wyly, E. *et al.* (2012) 'New Racial Meanings of Housing in America', *American Quarterly*, 64(3), pp. 571–604. Available at: https://doi.org/10.1353/aq.2012.0036.

Wyly, E.K., Atia, M. and Hammel, D.J. (2004) 'Has mortgage capital found an inner-city spatial fix?', *Housing Policy Debate*, 15(3), pp. 623–685. Available at: https://doi.org/10.1080/10511482.2004.9521516.

Wyly, E.K. and Holloway, S.R. (1999) '"The Color of Money" revisited: racial lending patterns in Atlanta's neighborhoods', *Housing Policy Debate*, 10(3), pp. 555–600. Available at: https://doi.org/10.1080/10511482.1999.9521344.

Xu, W. (2021) 'Legacies of institutionalized redlining: a comparison between speculative and implemented mortgage risk maps in Chicago, Illinois', *Housing Policy Debate*, 32(2), pp. 249–274. Available at: https://doi.org/10.1080/10511482.2020.1858924.

Zaimi, R. (2020) 'Making real estate markets: the co-production of race and property value in early 20th century appraisal science', *Antipode*, 52(5), pp. 1539–1559. Available at: https://doi.org/10.1111/anti.12642.

Zaimi, R. (2022) 'Rethinking "Disinvestment": Historical geographies of predatory property relations on Chicago's South Side', *Environment and Planning D: Society and Space*, 40(2), pp. 245–257. Available at: https://doi.org/10.1177/02637758211013041.

Zandbergen, P.A. and Ignizio, D.A. (2010) 'Comparison of dasymetric mapping techniques for small-area population estimates', *Cartography and Geographic Information Science*, 37(3), pp. 199–214. Available at: https://doi.org/10.1559/152304010792194985.

Zhong, R. and Popovich, N. (2022) 'How air pollution across America reflects racist policy from the 1930s', *The New York Times*, 9 March.

Zillow (2019) 'Zillow unveils smarter, more accurate Zestimate that "sees" unique home features, incorporates greater real-time data'. Zillow. Available at: https://zillow.mediaroom.com/2019-06-27-Zillow-Unveils-Smarter-More-Accurate-

Zestimate-That-Sees-Unique-Home-Features-Incorporates-Greater-Real-Time-Data?mobile=No.

Zukin, S. (1982) *Loft Living: Culture And Capital In Urban Change*. Baltimore: Johns Hopkins University Press.

Appendices

APPENDIX A:

HOUSING UNIT AND URBANIZATION ESTIMATES FOR THE CONTINENTAL U.S. IN CONSISTENT TRACT BOUNDARIES, 1940-2019[20]

[20] Markley, S., Holloway, S., Hafley, T., and Hauer, M. (2022) 'Housing unit and urbanization estimates for the continental U.S. in consistent tract boundaries, 1940–2019', *Scientific Data*, 9(1). Available at: https://doi.org/10.1038/S41597-022-01184-X. Reprinted here with permission of publisher.

Abstract

Subcounty housing unit counts are important for studying geo-historical patterns of (sub)urbanization, land-use change, and residential loss and gain. The most commonly used subcounty geographical unit for social research in the United States is the census tract. However, the changing geometries and historically incomplete coverage of tracts present significant obstacles for longitudinal analysis that existing datasets do not sufficiently address. Overcoming these barriers, we provide housing unit estimates in consistent 2010 tract boundaries for every census year from 1940 to 2010 plus 2019 for the entire continental US. Moreover, we develop an "urbanization year" indicator that denotes if and when tracts became "urbanized" during this timeframe. We produce these data by blending existing interpolation techniques with a novel procedure we call "maximum reabsorption." Conducting out-of-sample validation, we find that our hybrid approach generally produces more reliable estimates than existing alternatives. The final dataset, Historical Housing Unit and Urbanization Database 2010 (HHUUD10), has myriad potential uses for research involving housing, population, and land-use change, as well as (sub)urbanization.

Background and Summary

Social and environmental researchers have long aimed to improve how they analyze and understand changes to the built environment. In the United States, investigators frequently rely on multi-decadal, small-area housing unit data from the US Census Bureau to estimate the historical pace and extent of (sub)urbanization, analyze past geographies of housing loss and gain, categorize (sub)urban land types, examine

urban morphology, and project future patterns of population growth, development, and land use (Hackworth, 2005; Talen, 2014; Moura, Smith and Belzer, 2015; Hauer, Evans and Mishra, 2016; Balk *et al.*, 2018; Markley, 2018; Airgood-Obrycki, Hanlon and Rieger, 2021; Uhl *et al.*, 2021). Such efforts, however, have long been hindered by problems with historical data availability and compatibility. Specifically, the most commonly used small-area census geography, the census tract, did not cover the whole country until 1990 and is redrawn every ten years (Snow, 2011).

Our dataset fills a distinct niche left by existing data products—notably, HISDAC-US, NHGIS, and LTDB—that attempt to estimate historic subcounty housing units. These datasets, while exceptionally useful and often applied in the broader literature, come with shortcomings that HHUUD10 addresses. For example, HISDAC-US offers historical building counts and floor areas at unrivalled spatial and temporal resolutions (Leyk and Uhl, 2018). Its source data, however, comes from contemporary property records, subjecting its estimates to substantial survival bias in many cities that underwent "urban renewal" in the mid-to-late twentieth century (Greer, 1965; Teaford, 1990; Fullilove, 2004). Additionally, HISDAC-US comes as a raster dataset. Though rasters offer some noteworthy advantages, vector-polygons—namely, census tracts—are much more frequently used in social and demographic research.

The National Historical Geographic Information System (NHGIS) and Longitudinal Tract Database (LTDB) provide some historical housing unit counts in 2010 tract geometries (Logan, Xu and Stults, 2014; Manson *et al.*, 2021). Though shown to produce reasonably dependable population estimates for 2000 data, these data products only go back to 1990 and 1970, respectively. In addition, the LTDB's pre-1990 data

coverage is limited to US cities and metropolitan regions that were tracted in those years (Logan, Stults and Xu, 2016). Furthermore, in part because the LTDB focuses on a wide array of variables rather than housing units specifically, its pre-1990 housing data are generated using a coarse interpolation method that is highly susceptible to misallocation (Logan, Stults and Xu, 2016). Namely, they rely heavily on error-prone area-weighted interpolation, remove only water surfaces in their dasymetric refinement procedure, and use population weights rather than housing weights to generate their housing unit estimates (Logan, Xu and Stults, 2014).

Addressing these gaps in the available datasets, we develop a data product that provides housing unit count estimates in consistent census tract boundaries for every decennial census year from 1940 to 2010 plus 2019 for the entire Continental United States. We mitigate many of the common problems associated with spatiotemporal interpolation—including survivor bias, incomplete coverage, and misallocation—by taking a hybrid approach (Schroeder and Van Riper, 2013; Schroeder, 2017). Combining historical tract records from the NHGIS and land-use polygons from ArcGIS Online, as well as two privately distributed ancillary datasets, we blend and modify a series of well-established spatiotemporal interpolation techniques to generate pre-1990 housing unit estimates in places that contained pre-1990 tracts. These techniques include dasymetric refinement, selective areal weighting, and two variations of target-density weighting (Goodchild and Lam, 1980; Eicher and Brewer, 2001; Schroeder, 2007). For areas that were not tracted in their respective pre-1990 census year, we employ a novel raster overlay procedure that we call “maximum reabsorption.” For 1990 and later, we rely on NHGIS time series data.

We call our data product the Historical Housing Unit and Urbanization Database 2010 (HHUUD10). It consists of an Esri shapefile and GeoJSON file, as well as .csv, .dta, .xpt, and .v8xpt files in long and wide formats. Along with housing unit counts, HHUUD10 includes an estimated "urbanization year" indicating when a given tract surpassed a set urbanization threshold based on its housing density and land cover. The ancillary components used to estimate the urbanization year are also included in the dataset.

Out-of-sample validation reveals that our multi-method, hybrid approach better predicts past housing unit counts in most cases than any one of the component methods alone. We discuss our approach in full in the following section.

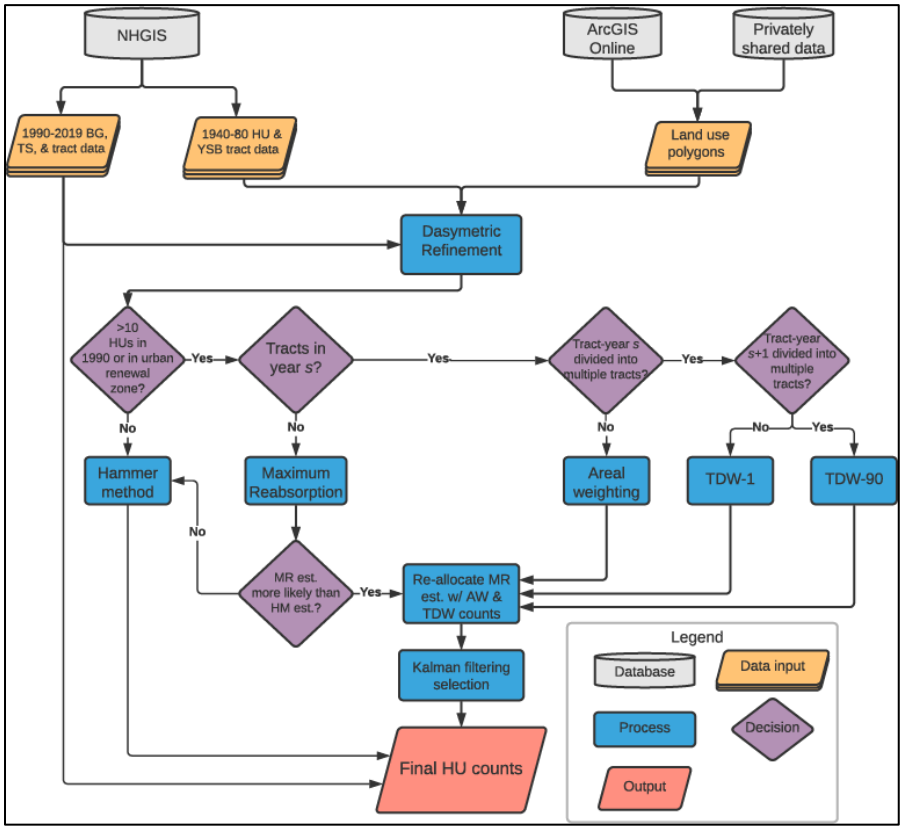


Figure A1.1. Workflow diagram illustrating the steps we take to produce our housing unit estimates.

Methods

Data Importation and Organization

In the continental US, there were 72,539 census tracts in 2010. We provide housing unit counts in these tracts across nine decades (1940–2010, 2019), or 652,851 (72,539 × 9) individual tract-years. Fortunately, the NHGIS provides complete estimates for tracts from 1990 and 2000 in 2010 boundaries. Therefore, we generate housing unit estimates for the 362,695 (72,539 × 5) tract-years from 1940 to 1980. We accomplish this by working through the steps outlined in the workflow diagram in **Figure A1.1**. In this subsection, we discuss the data collection and dasymetric refinement procedure.

The data we use to initiate the process come primarily from two sources: the NHGIS and Esri's ArcGIS Online. From the NHGIS, we first gather historical census data. These include housing units for every census tract in the continental US from 1940 through 1980 plus housing units from the 2010 decennial census and the 2015–2019 American Community Survey (ACS) (Manson *et al.*, 2021). In addition, we pull in four other data types from the NHGIS. These include year structure built (YSB) data for 1950-1980 tracts and 1990 block groups, 1990 and 2000 housing unit counts in 2010 tract boundaries from NHGIS's time series collection, a crosswalk file that transfers 1990 YSB data into 2010 block groups, and an environmental summary table containing National Land Cover Database (NLCD) land-use categories (Logan, Xu and Stults, 2014). We use this last dataset to generate our "urbanization year" variable, and we supplement it with Enhanced 1992 NLCD data (Nakagaki *et al.*, 2010).

From ArcGIS Online, we gather a series of nationwide land-use polygons, which are available to anyone with a standard ArcGIS user license. These layers include water

surfaces; parks; airport grounds; railyards; and golf courses, cemeteries, and industrial areas. These polygon surfaces indicate which areas likely contained no housing units during our study period. With this information, we are then able to dasymetrically refine our dataset by removing these spaces before interpolation, splitting our pre-1990 tracts into "inhabited" and "uninhabited" zones. Though computationally simple, this binary approach can significantly improve estimates, while often performing as well or better than more complicated techniques (Mennis, 2003; Langford, 2006; Zandbergen and Ignizio, 2010). Moreover, by using vector-polygons rather than the more standard 30-meter NLCD raster cells we improve the precision of our dasymetric procedure considerably.

One complication of the Esri data is that it does not indicate when the surface polygons were established. However, some of these surfaces have been constructed since 1940, possibly removing housing units in the process. Ideally, we would link each polygon to a construction date. Realistically, this is only feasible for airport grounds and golf courses. For the former, we obtain each airport's "activation date" from the Federal Aviation Administration and then subtract two years to account for construction time. For golf courses, we obtain a georeferenced point file with a year-opened attribute for golf courses in the US that were built by 2000 via private correspondence. These data originate from *Golf Magazine* and have been used in prior research (Napton and Laingen, 2008). Dates for both surfaces are then linked to their respective polygons so that dasymetric refinement would only be implemented after their construction. All but two of the remaining polygon surfaces are kept as they were for the entire study period. Swamps are removed from the water file because they can encompass homes, and we only include

parks that are less than five square miles because larger parks sometimes do contain residences.

Finally, 2010 tracts containing fewer than 10 housing units in 1990 according to the NHGIS's time series table are flagged for potential removal. This step corrects for dramatic changes in how the Census Bureau drew tracts during the course of the study period. However, since some of these tracts may have been a site of extreme housing loss due to urban renewal, which we aim to capture, we do not remove any tracts overlapping a known urban renewal project. A polygon boundary of federally funded urban renewal projects carried out between 1950 and 1966 is obtained via correspondence with the Digital Scholarship Lab at the University of Richmond (Nelson and Ayers, 2021). Housing unit values for these removed tracts are later re-entered using a backcasting procedure discussed below.

Following dasymetric refinement, we sort our 362,695 pre-1990 tract-years into three categories. First, there are target tracts that were covered by tracts in their respective source year ("tracts present"). Next, there are target tracts that were not covered by tracts in their source year ("not tracted"). Finally, there are special-case tracts with less than 10 housing units in 1990 that do not overlap any known urban renewal boundaries ("sparsely populated"). Each of these must be handled in different ways. **Figure A1.2** depicts how tract-years are split into these groups and then subsequently treated with an appropriate interpolation method. We discuss each in the following sections.

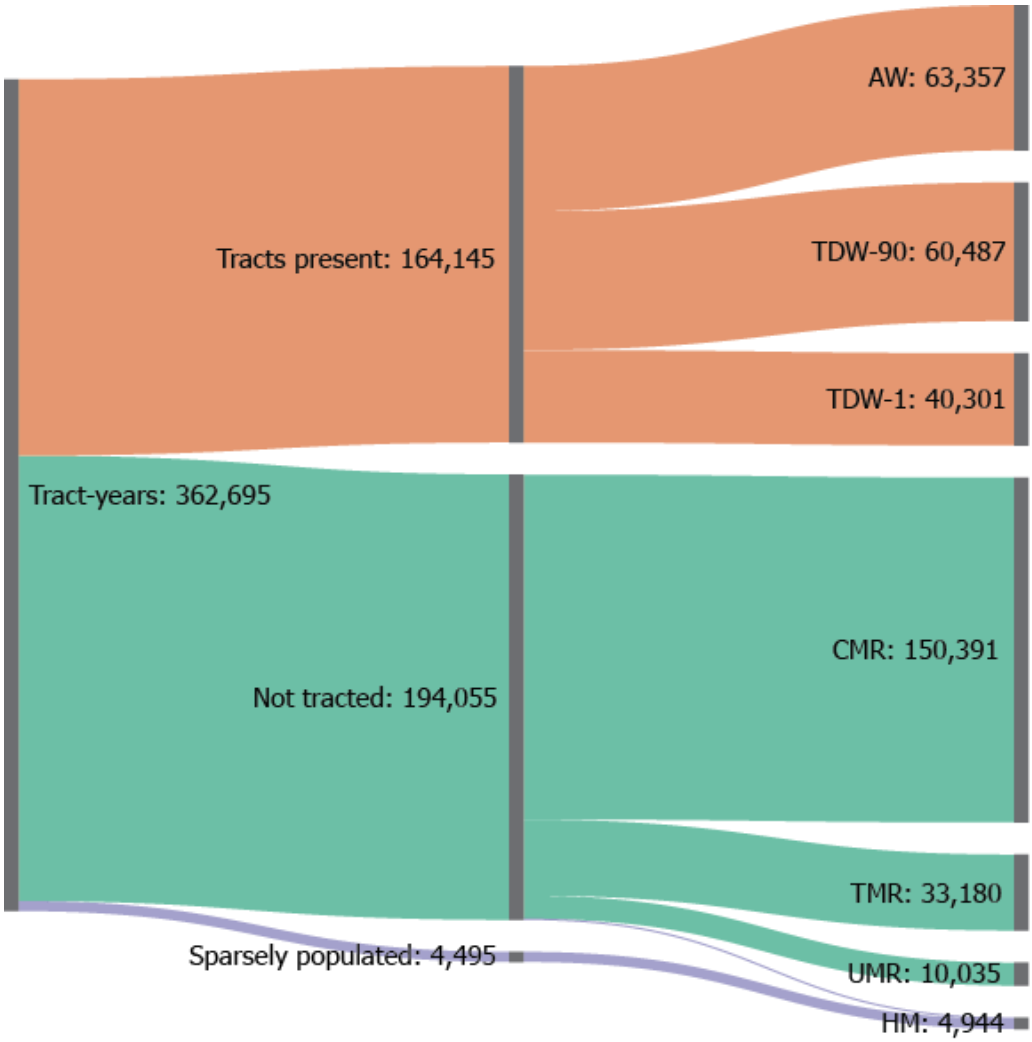


Figure A1.2. Sankey diagram depicting how our estimation methods are distributed among 1940–1980 tract-years.

Tracts Present

The basic objective of areal interpolation is to reallocate data from one vector-polygon into another. In our case, this entails moving housing unit counts from pre-1990 tracts into 2010 tract geometries. The simplest and most direct method for accomplishing this is areal weighting (AW) (Goodchild and Lam, 1980). AW is conducted by overlaying source and target tracts, and then using the proportion of the overlapping area

to distribute housing units from the former to the latter. The weakness of this approach is that it assumes housing units are distributed uniformly across the source layer, which is rarely the case. Dasymetric refinement is therefore applied to update our assumptions about the within-tract spatial distribution of housing units and improve interpolation results accordingly (Eicher and Brewer, 2001; Mennis, 2009).

Dasymetrically refined AW works well in cases where source geographies remain the same size or are aggregated over time. In such cases, AW can indeed be preferred to other methods because it retains original census housing unit counts and is thus unaffected by survivorship bias. Ideally, we would conduct AW using the smallest census geography, the census block, to minimize misallocation (Schroeder, 2017). However, neither census blocks nor block groups are available on a national scale before 1990, and there is not a dependable way to tell if 1990 block data with few or no housing units had housing units in the past. In order to capture housing unit loss, we proceed cautiously and apply dasymetrically refined AW only to tracts that remained the same size or grew over the study period (n = 65,510).

AW works less well in cases where tracts are subdivided between census years. These cases are typically the result of population growth, which rarely occurs evenly within tract boundaries. To address this problem, Schroeder proposes “target density weighting” (TDW) (Schroeder, 2007). Like AW, TDW begins with an overlay of the source and target layers. Instead of using the area overlap to proportionally allocate source-year housing units into their target zone (*e.g.*, 2010 tracts) though, TDW assumes that the spatial distribution of housing units in the source tract is equivalent to the spatial distribution of a corresponding variable in the target zone. For us, that corresponding

variable is the YSB count of housing units built by the source year according to the target-zone data (1990 YSB data reapportioned to 2010 block groups). TDW is thus calculated as

$$\hat{y}_t = \sum_s \frac{\left(\frac{A_{st}}{A_t}\right) z_t}{\sum_\tau \left(\frac{A_{s\tau}}{A_\tau}\right) z_\tau} y_s$$

where, in our case, $\hat{y}_t$ is the estimated housing unit count in target zone *t* (2010 tracts), y_s is the housing unit count in the source year *s*, z_t is the YSB count for source year *s* in target zone *t*, A_t is the area of target zone *t*, A_{st} is the area of the overlap between source tract *s* and target zone *t* (the "atom"), and τ indexes the individual target zones that overlap a given source tract (Schroeder, 2007; Buttenfield, Ruther and Leyk, 2015).

Ruther and colleagues (2015) find that dasymetrically refined TDW outperformed six other interpolation methods when distributing population counts from 1990 and 2000 tracts to 2010 tracts. However, results from 1990 were less reliable than 2000, suggesting that this method is sensitive to temporal distance, especially in places undergoing either population decline or fast growth. TDW is thus ill-equipped to capture the rapid housing unit loss associated with mid-twentieth century urban renewal. However, by already accounting for tracts that stayed the same size or grew in size with AW, our use of TDW is limited to source-year tracts that were subdivided during the study period. Such tracts typically gained population and hence were unlikely to experience dramatic housing loss. And since we use YSB counts from the target zone rather than housing units, the rapid growth problem is effectively neutralized.

Temporal distance remains a concern, however. We address it by applying two different types of TDW that, when combined, minimize temporal distance where possible. For the first, which we call "TDW-1," we walk housing units from the source year into the tracts in the following decade ($s + 1$)—provided they were subdivided—with TDW using the latter's YSB counts. Then, for tracts $s + 1$ that stay the same size or grow in area before the target year, we conduct AW. There are 40,416 cases in which TDW-1 is applied, about 72 percent of which are from 1980. Source tracts remaining are those that were subdivided across subsequent decades. For these, we apply a more standard TDW using 1990 YSB counts in 2010 block groups. We call this set "TDW-90," and we apply it to 59,658 tract-years.

For all three of these methods, we include a quality check step that compares the estimate produced with the tract's YSB value for the given source year. In theory, the YSB value from 1990 should never be greater than the AW or TDW estimates, except in the relatively infrequent cases wherein a large concentration of older housing units was divided into apartments. To correct these likely mistakes without removing the latter, we keep only the AW and TDW housing estimates that were 90 percent or greater than the YSB count. Cases failing to meet this threshold are handled as if they were non-tracted. Similarly, we keep only the target-zone tracts that were at least 99 percent covered by their source-year tracts, relegating partial overlaps to the non-tracted group.

Not tracted

In 1940, the Census Bureau had only drawn tracts for a little over 80 cities (Snow, 2011). In each decade after, coverage was expanded until the entire country was tracted

in 1990 (see **Figures A1.3** and **A1.4**). Missing pre-1990 census tract data presents a serious problem for interpolation because the methods described above can only be applied where historical tract boundaries exist. Hammer and colleagues present one solution (Hammer *et al.*, 2004; see also Hauer, Evans and Mishra, 2016). They use the YSB data in present-day tracts to proportionally allocate county-level housing unit counts available in historical census records. This approach is appealing for its simplicity, and unlike the previous methods discussed, it is not subject to any error from spatial interpolation. However, as with TDW, the Hammer method is sensitive to temporal distance.

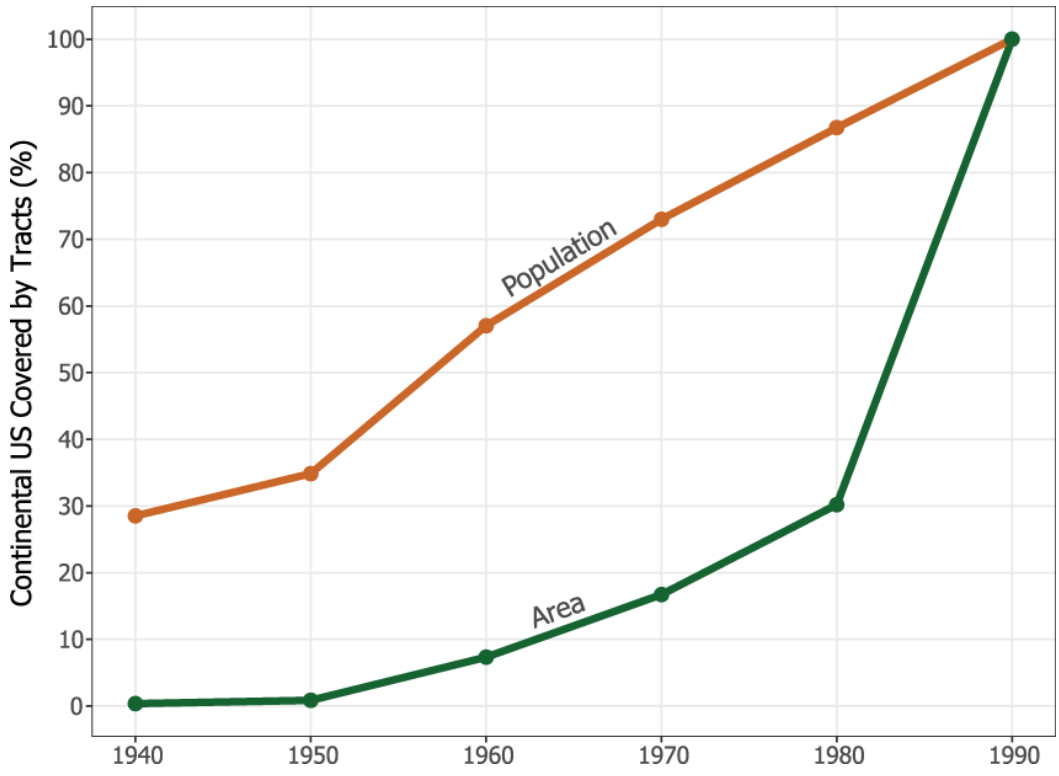


Figure A1.3. Graph of the percentage of the Continental US's area and population covered by census tracts, 1940–1990. Since the Census Bureau initially only targeted cities for tract coverage, only a tiny fraction of the total US land area was covered by tracts in the mid-to-late twentieth century, while a considerably greater portion of the total population lived in tracts.

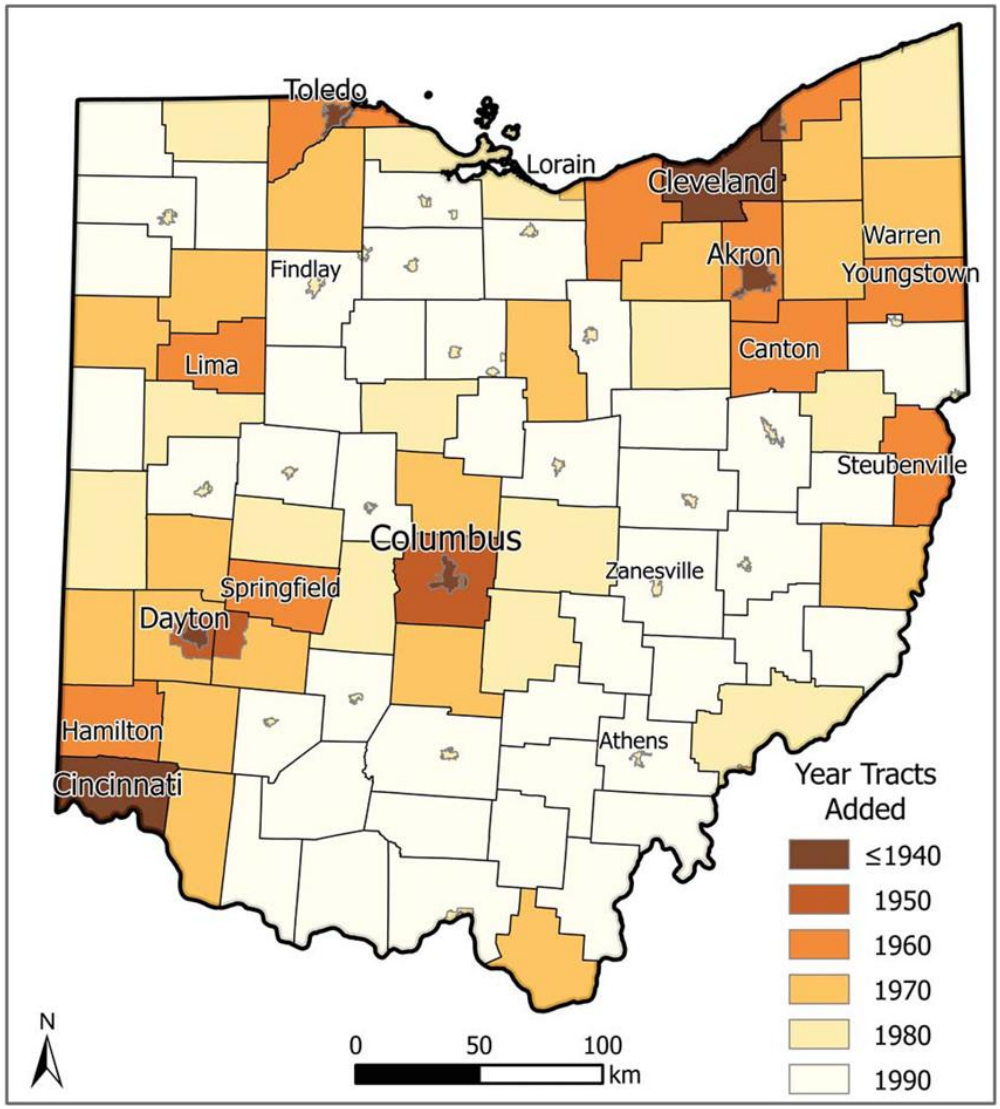


Figure A1.4. Historical census tract coverage in Ohio, 1940–1990. This map displaying the expansion of tract coverage in Ohio is representative of the general trend across the rest of the country. In 1940, only major cities were tracted. In 1950, tract expansion was limited to a few other cities and areas immediately surrounding a handful of already-tracted places. Over the ensuing decades, tracts were expanded to cover smaller and smaller cities and suburban regions until all areas were tracted in 1990.

A principal assumption guiding us thus far has been that a shorter temporal distance will tend to yield more accurate housing estimates than a longer temporal

distance. Therefore, we would prefer to gather housing unit data from pre-1990 tracts where available. However, we also make a countervailing assumption. Over time, the spatial resolution and border accuracy of tracts have generally improved and have grown closer to our target geometries (2010 tracts). Thus, YSB counts in more recent tract-years may provide more accurate housing unit estimates than older tract-years in some places. Our task is then to balance our conflicting preferences for minimal temporal distance and maximal spatial resolution. We thus develop "maximum reabsorption."

The first step of maximum reabsorption (MR) is to organize YSB totals for the source year (year *s* in **Figure A1.1**) for tracts in every subsequent decade up until 1980, plus in the 2010 block group polygons with 1990 data. If the source year is 1950, for example, the YSB totals for tracts from 1960, 1970, and 1980 and for block groups from 1990 would include their respective YSB counts for "1939 and earlier" summed with their YSB counts for "1940 to 1949." The resulting total would then indicate the surviving number of housing units built in a given tract by 1950. Once this data is organized for every source year (1940–1980), it is then converted to 30 × 30-meter raster cells. Each raster cell contains an estimated YSB count, calculated as its tract's YSB count divided by the number of cells contained within that tract. YSB counts are hence assumed to be evenly distributed within each dasymetrically refined tract polygon.

Following rasterization, each source year is left with a set number of associated raster layers, each with their own YSB-derived housing unit estimates. There are six rasters for 1940 (1940–1990), five for 1950 (1950–1990), and so on. Here, we arrive at that crucial juncture: how do we weigh temporal distance against spatial resolution? Our solution is to overlay each raster layer for each source year and then extract the *maximum*

housing unit count by raster cell. The logic is the same as before: YSB counts for a given source year in a future tract-year should theoretically never be greater than the original housing unit counts, except where there is a high concentration of older homes that have been divided into multiple units or where formerly non-residential buildings are converted into apartments or condominiums. However, since these practices have historically been observed in urban centers, these cases have mostly been handled by AW or TDW (Zukin, 1982; Hirsch, 1983). Therefore, the only reason a more recent YSB count should be greater than an older YSB count in remaining raster cells is if the more recent census geometry covers a smaller area than the older tract. Using the maximum thus favors spatial resolution over temporal distance in these cases and the reverse in all other cases.

The next step in the process is to "reabsorb" the new "maximum" cells back into target tracts. This is conducted in ArcGIS Pro using zonal statistics to sum each cell value in its 2010 tract boundary, producing a housing estimate for each source year in their respective target tract. These figures are not final, however. Using maximums implies that housing counts are overestimated in some places. To mitigate this potential issue, we use our MR estimates as weights to proportionally distribute historical county-level housing unit counts into 2010 tract boundaries. Counties that changed size or shape during the study period (*e.g.*, many of Virginia's county-equivalent cities) are amassed into larger county-units to ensure proper allocation.

We call this first cut "County-based Maximum Reabsorption," or "CMR," However, there are two potential adjustments to be made. First, there are cases in which the proportional allocation procedure reduces the CMR value below 90 percent of its

YSB value. In these cases, the unadjusted maximum was likely the more dependable value, so we either kept it unadjusted (UMR) or used the Hammer method (HM) instead. We choose the value that is closer to the 1990 YSB count because this generally yields the more conservative estimate. In 9,859 cases, this leaves us with the UMR count, and in only 439 cases, it gives us the HM count. After subbing in these new values, CMR estimates for the remaining tracts are recalibrated.

The second adjustment looks to improve our MR estimates with "Tract-based Maximum Reabsorption," or "TMR." By subtracting AW and TDW estimates from county totals, we can reduce the number of MR-estimated tract-years in need of reallocation. This should, in theory, improve our maximum reabsorption figures in all county-years with partial tract coverage. Unfortunately, census data itself is not always consistent, especially in older census years (Manson *et al.*, 2021). For example, since tracts are nested within counties, county housing counts should equal the sum of their tract counts. However, there are some significant discrepancies. In the worst of these cases—Kings County, NY (Brooklyn) in 1960—there are over 35,000 more housing units in the county-level census file than in the sum of that county's census tracts.

Unless TMR comes back as a negative value, there are few ways to identify which method yields the more dependable result. To help us in this task, we employ Kalman filtering for tracts with at least one source year relying on maximum reabsorption. Kalman filtering is a univariate time series approach that forecasts—or, in our case, backcasts—estimates using existing observations (Moritz and Bartz-Beielstein, 2017). Thus, we use the 2019, 2010, 2000, and 1990 housing unit counts already in our dataset, in addition to any other produced by AW, TDW, UMR, or HM, to generate a

predicted housing count for a given tract-year. Then, we select the CMR or TMR estimate that is closer to the Kalman estimate. Since this approach requires observed data on both ends of the projection to work properly, we impute missing 1940 values by selecting either the CMR or TMR estimates that is closer to the HM estimate. These procedures yield 149,231 CMR estimates and 33,087 TMR estimates.

Sparsely Populated

The final tract-years in need of estimation represent only slightly more than one percent of the total (n = 4,495). These special cases are primarily constituted by large sparsely populated zones—including airports, parks, commercial or industrial districts, federal lands, and the like—that were assigned their own tract by the Census Bureau in 2010. Assigning these sparsely populated zones to their own tract, rather than subsuming them in their neighbor's populated tract, is a relatively recent practice. Thus, when redistributing data from old census tracts to recent ones, there is a high risk of misallocation in these instances if not appropriately managed.

We specified how we identified these cases above. These are tracts with less than 10 housing units in 1990 that did not overlap a known urban renewal area. We handle these rare cases by removing them from the dataset before interpolation before reintroducing them after. We then perform the Hammer method using their YSB estimates and the YSB estimates from all other tracts in their county equivalent.

Urbanization Estimation

Our final task is to provide urbanization year estimates in each 2010 tract. We do this in two cuts. First, following the common practices of housing researchers, we define a tract as "(sub)urbanized" when it surpasses 200 housing units per square mile (Cooke and Marchant, 2006; Romem, 2016; Airgood-Obrycki, 2019). Notably, the area used for calculation is a tract's populated dasymetric zone not including its "industrial areas." We call this "UY1" (Urbanization Year One), and it spans from 1940 to 2019. Once a tract surpasses this threshold, our definition does not allow it to become "unurbanized," though HHUUD10 users can easily change this feature if they wish.

UY1 captures most tracts one would expect. However, it still leaves conspicuous holes on the urban landscape (see **Figure A1.5**). There are many places typically considered "urban" that do not contain many housing units and have not been removed during dasymetric refinement, such as large commercial and industrial districts. To account for these other urban land uses, we pull in NLCD categories from 1992, 2001, and 2011. Conveniently, the NHGIS has distributed 2001 and 2011 NLCD land cover types in 2010 tract boundaries. To estimate the percentage of land area covered by an urban land use, we simply sum the four "Developed" land cover classifications and then divide them by the total land area minus "Open Water" and "Perennial Ice/Snow." This produces a "percent developed" category we use to update UY1 into UY2.

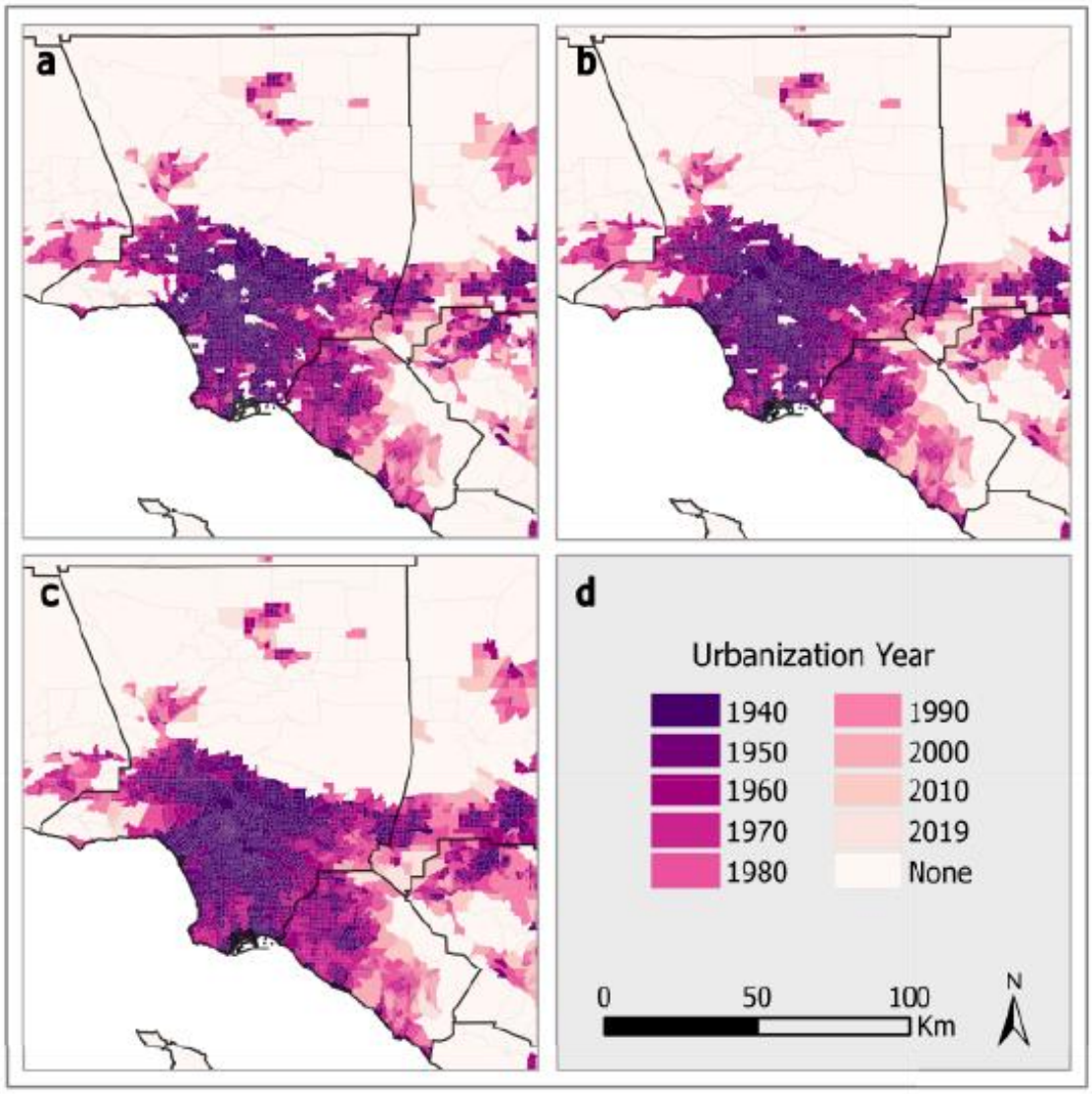


Figure A1.5. Maps comparing three ways to define urbanization years (UY) in Greater Los Angeles. All use 200 housing units per square mile. (a) Hammer-generated UY. (b) HHUUD10-generated UY using housing units only (UY1). (c) HHUUD10-generated UY supplemented with NLCD and tract adjacency information to account for non-residential urbanized tracts (UY2). (d) Map elements.

NLCD data from 1992 is not as conveniently packaged. It is only available in its original raster format. For that data, we replicate the methods of the NHGIS to aggregate NLCD classifications into our target tracts and then perform the same tasks outlined

above. The major distinction is that the NLCD calculated and named the 1992 classifications slightly differently. Rather than using "developed" classifications, we approximate urban land uses by summing "Low" and "High Intensity Residential," "Commercial/Industrial/Transportation," "NLCD/LULC Forested Residential," and "Urban/Recreational Grasses" (Nakagaki, 2010).

The output from these procedures are three data columns in our dataset indicating the percentage of land that was developed in 1992, 2001, and 2011. With that information, we identify tracts for each NLCD year with an urban land coverage above 50 percent and an urbanization year later than 1990, 2000, and 2010, respectively. For these special cases, we calculate a UY2 value using the weighted average of their neighbors' UY1 values. The weights in this equation are their shared border lengths. For purposes of averaging, tracts that were not yet urbanized are given a pseudo UY1 of 2035.

Following these modifications, we conduct an urban smoothing technique that assigns tracts surrounded by neighbors with earlier urbanization years a new UY2 value using the latest bordering UY2 value. For example, a 2000 UY2 tract surrounded by 1970 and 1980 UY2 tracts would receive a new UY2 value of 1980. The theoretical basis here is that these islands are less likely to be categorically distinct from their neighbors than to be the result of the inherent limitations of using vector polygons to capture urban development. Following this step, we have the final data product, presented in map form in **Figure A1.6**. It includes housing unit counts and the "inhabited" surface areas from 1940 to 2019; a "percent developed" category for 1992, 2001, and 2011; and two

urbanization years, one solely housing density based (UY1), the other corrected to include non-housing unit urban land uses (UY2).

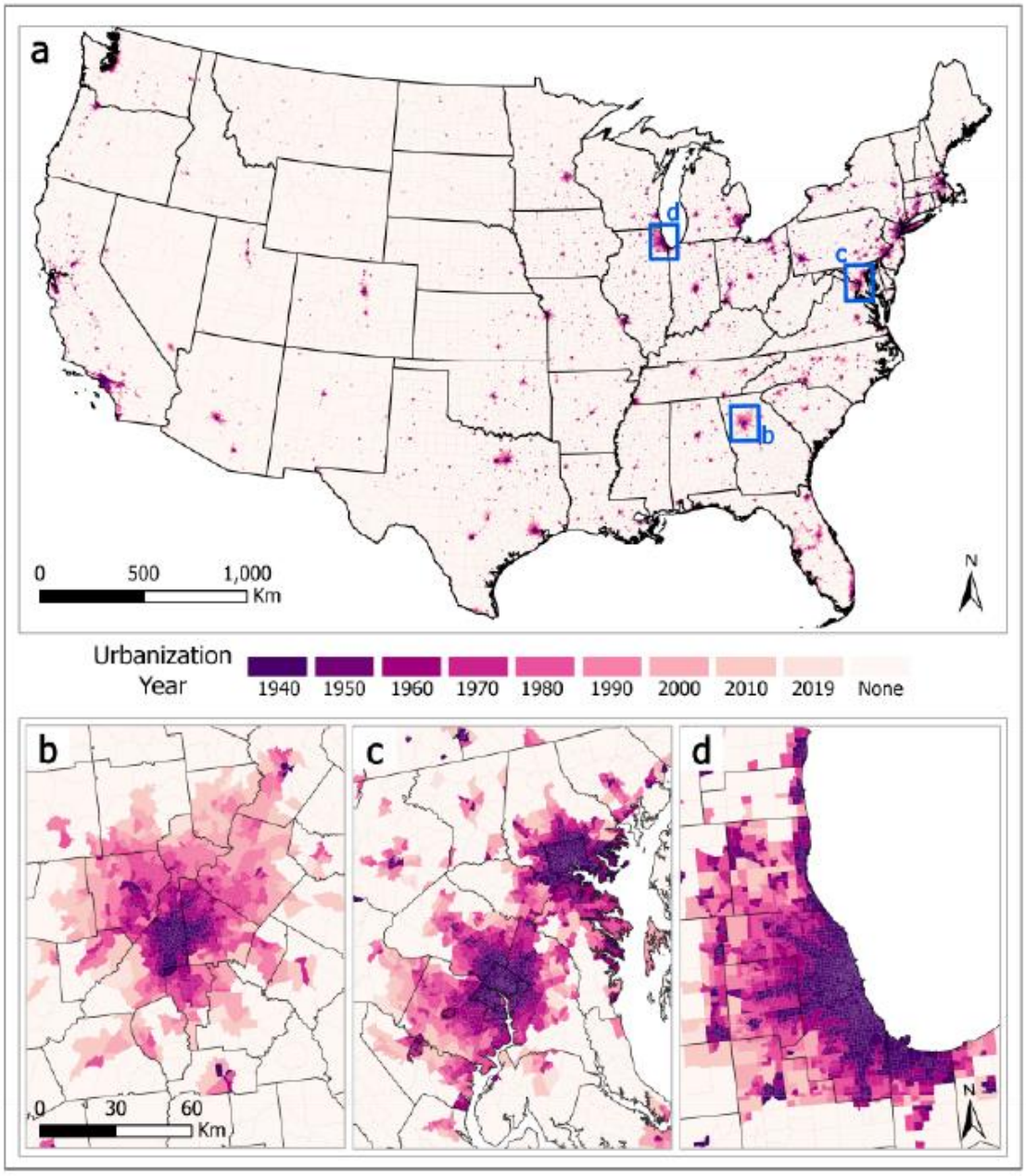


Figure A1.6. HHUUD10 Urbanization Years by tract for (a) the Continental US, (b) Greater Atlanta, GA, (c) the Baltimore-Washington, DC-MD-VA Area, and (d) Greater Chicago, IL-IN-WI.

Data Records

All HHUUD10 data are available for download at the Open Science Foundation (OSF) (Markley *et al.*, 2022a). This repository includes an Esri shapefile and GeoJSON file, as well as .csv, .dta, .xpt, and .v8xpt files in long and wide formats. The data contained in each file are identical. Table A1.1 defines and summarizes the data columns in the long HHUUD10 file.

Table A1.1. Data description for HHUUD10.

Variable	Description
STATE	State abbreviation.
COUNTY	County name.
GISJOIN10	Unique tract ID in NHGIS format.
GEOID10	Unique tract ID in Census Bureau format.
YEAR	Year of HU & SQMI data (1940-2019). In wide format, the last two digits in the year trail the variable name (e.g., hu40, sqmi40, etc.).
HU	Tract housing unit estimate by year.
SQMI	Area of dasymetrically refined tract in sq. mi. by year. These values are constant throughout the study period except are reduced when an airport or golf course is constructed.
pdev92	Percent of a tract's land area that was covered by an urban land use according to the NLCDe 1992.
pdev01	Percent of a tract's land area that was covered by an urban land use according to the NLCD 2001.
pdev11	Percent of a tract's land area that was covered by an urban land use according to the NLCD 2011.
UY1	Urbanization year according to when a tract surpassed 200 HU / sq. mi. in its dasymetrically refined area.
UY2	Same as UY1, except urbanized non-residential areas identified by the pdev variables and tract adjacency are included.

Technical Validation

To evaluate how our HHUUD10 method performs against other methods, we apply three validation tests. The first two compare results from our hybrid method against

those from its component methods. The third shows the distribution of the estimated error in tracted and non-tracted spaces in our validation sample. To conduct these tests, we use nine sample counties to generate 1990 housing unit estimates in 2010 tract geometries with NHGIS time series data as the "observed" data. Although this dataset itself is imperfect, it is the industry standard and has been shown to outperform alternative datasets (Logan, Stults and Xu, 2016).

Other than the historical availability of tract data, the main factor that can skew our estimates is the rate at which an area gains or loses housing units between the source and target years. Thus, following previous studies, we run our validation on a sample of counties with different growth trajectories from 1990 to 2015–19 (Buttenfield, Ruther and Leyk, 2015; Ruther, Leyk and Buttenfield, 2015). We include three counties that experienced housing unit decline in that time, three that experienced rapid growth, and three that were relatively stable. **Table A1.2** shows the breakdown.

Table A1.2. Nine county sample used for validation.

Growth Trajectory	County	Primary City	HUs (1990)	HUs (2015-19)	Change
Declining	Orleans Par., LA	New Orleans	225,573	191,808	-33,765
	St. Louis city, MO	St. Louis	194,919	176,729	-18,190
	Wayne Co., MI	Detroit	832,710	815,102	-17,608
Growing	Orange Co., FL	Orlando	282,686	535,981	253,295
	Tarrant Co., TX	Fort Worth	491,152	767,808	276,656
	Riverside Co., CA	Riverside	483,847	840,501	356,654
Stable	Allegheny Co., PA	Pittsburgh	580,738	600,399	19,661
	Essex Co., NJ	Newark	298,710	317,314	18,604
	Hamilton Co., OH	Cincinnati	361,421	379,402	17,981

For our first validation test, we compare our hybrid model of dasymetrically refined (DR) AW, TDW-1, and TDW-90 against DR-AW and DR-TDW alone. Results

are presented in **Table A1.3**. We use two statistics of comparison: Median Absolute Percent Error (MdAPE) and symmetric Mean Absolute Percent Error (sMAPE). Unlike Mean Absolute Percent Error (MAPE), these measures avoid having to divide by zero and are more resilient against extreme values (Hyndman and Koehler, 2006). In all growth scenarios, as well as among the total, our HHUUD10 method performs better by these measures than both DR-AW and DR-TDW alone. The differences between HHUUD10 and DR-TDW are quite close, however. One reason this may be is that the NHGIS relies heavily on DR-TDW to produce their estimates—though they do this at the block level, use housing counts instead of YSB, and employ a different DR process—so there is some risk of tautology (Manson *et al.*, 2021). While DR-AW performs nearly on par with HHUUD10 and DR-TDW in declining and stable counties, its large errors in growing counties demonstrate why AW should only be used in specific cases.

Table A1.3. Comparing 1990 housing unit estimates in 2010 tract geometries: HHUUD10 vs. DR-AW and DR-TDW using Median Absolute Percent Error (MdAPE) and symmetric Mean Absolute Percent Error (sAPE). Italicized figures indicate the lowest errors in their group.

County Type	**Method**	**MdAPE**	**sMAPE**	**tracts (n)**
Declining	HHUUD10	*0.003*	*0.027*	891
	DR-AW	0.004	0.053	
	DR-TDW	0.003	0.032	
Growing	HHUUD10	*0.061*	*0.228*	1017
	DR-AW	0.241	0.452	
	DR-TDW	0.137	0.293	
Stable	HHUUD10	*0.013*	*0.056*	834
	DR-AW	0.016	0.073	
	DR-TDW	0.014	0.056	
Total	HHUUD10	*0.012*	*0.111*	2742
	DR-AW	0.018	0.207	
	DR-TDW	0.016	0.136	

For our second validation test, we mimic historical census tract availability by removing two-thirds of 1990 tracts and one-third of 2000 tracts. Following historical patterns, we include only those tracts around the urban center in 1990 and then radiate outward from there. Though imperfect, this scenario allows us to compare HHUUD10 against CMR and HM estimates. Additionally, it allows us to see how substituting HM estimates in for CMR estimates would change our HHUUD10 counts. **Table A1.4** reports the results.

Table A1.4. Comparing 1990 housing unit estimates in 2010 tract geometries: HHUUD10 vs. HHUUD-HM, CMR, and HM using Median Absolute Percent Error (MdAPE) and symmetric Mean Absolute Percent Error (sAPE). Italicized figures indicate the lowest errors in their group.

County Type	Method	MdAPE	sMAPE	Tracts (n)
Declining	HHUUD10	*0.046*	*0.123*	891
	HHUUD-HM	0.074	0.151	
	CMR	0.068	0.140	
	HM	0.136	0.211	
Growing	HHUUD10	*0.106*	0.211	1017
	HHUUD-HM	0.110	0.217	
	CMR	0.117	0.229	
	HM	0.114	*0.206*	
Stable	HHUUD10	*0.050*	*0.093*	834
	HHUUD-HM	0.058	0.114	
	CMR	0.072	0.113	
	HM	0.080	0.148	
Total	HHUUD10	*0.066*	*0.146*	2742
	HHUUD-HM	0.083	0.164	
	CMR	0.083	0.165	
	HM	0.106	0.190	

Errors in this test are considerably higher than their counterparts in the previous test. This reflects what happens to the accuracy of estimates when historical tract data is unavailable. Still, the HHUUD10 method outperforms the other methods by both

measures among declining and stable counties and overall. In fast growing counties, HHUUD10 has the lowest MdAPE, but the Hammer method has a slightly lower sMAPE. This is likely due to the fact that the Hammer method is not subject to any error associated with areal interpolation, and although the HM is affected by survivorship bias, that is much less of a concern in fast-growing places in this time period. Applying the HM over a longer time period when housing demolition was more rampant, such as during the height of urban renewal in the 1950s and 1960s, would assuredly yield less reliable estimates.

Our third test separates tracted from non-tracted spaces to demonstrate the distribution of their errors around zero (see **Figure A1.7**). The error metric used here is the Algebraic Percent Error (ALPE), which is the same as sMAPE shown above, except it does not take the absolute value (Hauer, 2019). The density plots in **Figure A1.7** show that, as we would expect, the error for tracted spaces tends to be much smaller on average than the error in non-tracted spaces. This is especially true in declining counties where the areal interpolation methods are best at predicting housing counts. The distribution of errors is much wider in non-tracted spaces for all growth trajectories, suggesting that HHUUD10's estimates are likely less dependable, on average, in earlier census years and in less populated counties where tract coverage was less complete.

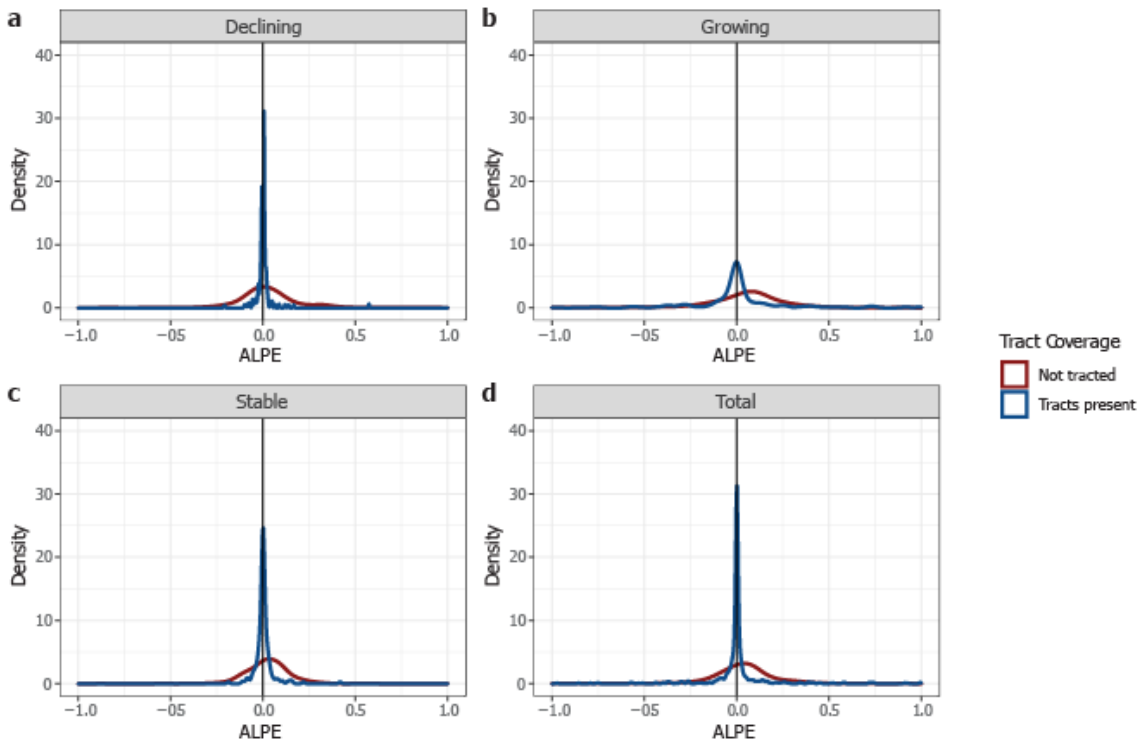


*Figure A1.7. Algebraic Percent Errors (ALPE) in tracted and non-tracted spaces. (**a**) ALPE in Declining counties (**b**) ALPE in Growing counties (**c**) ALPE in Stable counties (**d**) ALPE in all nine sample counties.*

Usage Notes

HHUUD10 provides housing unit counts and urbanization estimates for every census tract in the continental US in consistent boundaries. The data itself may be used for a longitudinal study directly addressing questions about housing, (sub)urbanization, or land-use change, or it may provide a useful input or control variable for studies focusing on other pertinent questions. This data may also help researchers reallocate other census variables into consistent tract boundaries. For any of these potential uses, users should keep three limitations in mind.

First, users of HHUUD10 should note that our dataset includes the sum total of housing units in a given tract-year. Thus, HHUUD10 does not allow for an exact assessment of how many housing units were demolished or constructed. For example, if ten housing units were demolished and subsequently replaced with twenty housing units within a census decade, HHUUD10 only registers the additional ten units. It does not register ten units lost and twenty gained. Researchers using HHUUD10 should design their studies with this in mind.

Second, we recommend that users acknowledge the intention and limitations of our "urbanization year" calculation. This estimate is designed to be used primarily as an input variable in studies involving (sub)urbanization, land-use change, and the like. It hence reflects a specific, density- and land-use-based definition of "urbanization" that does not allow tracts to ever become "unurbanized." Researchers aiming to capture "de-urbanization," for example, can use the other variables in the dataset to construct an alternative urbanization definition that is more suitable for their needs.

Finally, at every step in our interpolation procedures, we choose the method previous studies and our own expertise suggest will produce the most accurate possible estimate. Still, no data interpolation process is without error, and as our validation tests show, this is especially true in our case when there is no historical tract data available. Users should be aware of this.

To help data users assess our procedures, we publish all R and Python code used to construct this dataset and its validation (see below). Those wishing to run this code must register for a free account with the NHGIS, request a free API key from the US Census Bureau, and obtain a standard Esri user license through their institution or via

purchase. They will also need to install recent versions of R, ArcGIS Pro, and ArcGIS Desktop on their computers. We recommend that users run this code on an external hard drive with at least half a terabyte of memory, and we advise users that running the entire code will take several days. Further instructions are provided in our repository's README files. These must be followed carefully for the code to run properly.

Code Availability

All source code used in this analysis is available on Open Science Framework (OSF).39 This code was run using R 4.0.5, ArcGIS Pro 2.8 (with Python 3), and ArcGIS Desktop 10.7.

APPENDIX B:

AREAL INTERPOLATION

The National Historical Geographic Information System (NHGIS) at the University of Minnesota provides a time series dataset that includes the census variables I need in 2010 vintage tract geometries (Manson *et al.*, 2021). However, this dataset only goes back to 1990. Data back to 1970 is available from the Longitudinal Tract Database (LTDB) (Logan, Xu and Stults, 2014), but this dataset has been shown to have fairly large errors in its non-population variables (Logan, Stults and Xu, 2016; Logan *et al.*, 2021). That means that for census years before 1990, I must develop a method to convert the variables I need from their historical tract geometries into 2010 vintage census tracts. But that is not all. Since many cities in my study area were not fully tracted until 1970 (see **Figure A1.3** and **A1.4**), I must also develop a method to produce historical estimates in 2010 tract geometries where pre-1970 tracts are unavailable. Moreover, I must convert these tract data to HOLC neighborhood boundaries.

Population and Housing Variables

There is a vast literature on converting population and housing data from one geometry to another. One of the simplest approaches is called *area-weighted interpolation*, or *areal weighting* (Goodchild and Lam, 1980; see also Logan, Xu and Stults, 2014; Appendix A). This method uses the area overlap of the source and target

zones to proportionally allocate data from the former to the latter. The primary shortcoming of this approach is that it speciously assumes the variable being reallocated is evenly distributed within tracts, which can present a major problem when large portions of a tract are uninhabited. There is a fairly simple way to help correct for this issue though. Estimates generated from areal weighting can be markedly improved by employing a simple procedure known as *binary dasymetric refinement*, whereby ancillary land-use data is employed to cut out areas of the source and target zones known to have no residents—such as water bodies, airports, parks, cemeteries, and the like (see Eicher and Brewer, 2001; Mennis, 2009). By removing these unpopulated regions before conducting areal weighting, binary dasymetric refinement allows us to upgrade our assumptions about the intra-tract spatial distribution of the variable in question.

Dasymetrically refined areal weighting (DR-AW) still has many limitations, however. Of course, it cannot perfectly solve the problem of misallocation; it can only reduce potential error. More pressing for my purposes, though, is that DR-AW can only reliably be deployed where source zone data is available. In cases where historical census data is absent—such as in many urban places in my study area prior to 1970—I need to be more creative. Specifically, I need to plug the gaps left by the missing data with additional sources of information. Three sources are particularly useful for this task. The first is historical county-level census data. The second is tract-level data from a more recent census vintage. The third is the recently produced Historical Housing Unit and Urbanization Database v2010 (HHUUD10), which already provides 2010 vintage tract-level housing unit counts for the Continental US from 1940 to 2019 (see Appendix A).

Where historical census tract data is missing in a given space, county-level data from that census year can help improve the estimate. Since tracts are nested within counties, variables in a given county's non-tracted region can be approximated by calculating the difference between its county total and its aggregated tract total. For count variables like population or housing units, it is a matter of subtracting the latter from the former. For monetary variables like median home value, it is a matter of taking a weighted mean using the owner-occupied housing units as the weights. The results in both cases will be a refined estimate for the non-tracted portion of the county.

The next step would then be to distribute the estimate to 2010 census tracts. For count variables, it is possible to use DR-AW, but this approach is likely to produce substantial error since the source geometry—*i.e.*, non-tracted county space—is often quite large. Moreover, DR-AW will not be helpful for interpolating the monetary variables. It will merely assign the same value to all tracts. To address these shortcomings, Schroeder (2007) proposes an alternative approach he calls *target density weighting* (TDW). Rather than assuming the variables in question are evenly distributed across the source and target geometries, TDW assumes their spatial distribution in the source year matches their spatial distribution in the target year—or preferably in the first year in which tract-level data is available in that space. For instance, say tracts are unavailable in a given space in 1940 but become available in that space in 1950. For the 1940 population, we have already generated a subcounty, non-tracted area estimate from the step described above. Using TDW, we could then use the population counts in 1950 tracts to proportionally allocate that 1940 non-tracted area estimate to 1950 tract geometries. And we could do the same with monetary values using owner-occupied

housing unit counts as weights. Then, with that information, we could conduct DR-AW to walk that 1940 value in 1950 vintage tracts to our target geometry: 2010 vintage tracts.

In most cases, a dasymetrically refined TDW (DR-TDW) approach performs better than a simple DR-AW approach (Ruther, Leyk and Buttenfield, 2015; Logan, Stults and Xu, 2016; Markley *et al.*, 2022b). Indeed, for this reason, NHGIS relies heavily on DR-TDW to produce its time series dataset (Manson *et al.*, 2021). However, TDW-derived estimates have problems as well. Their errors can grow quite large when the geography of an area's population dramatically changes between the source and target years—*e.g.*, due to migration, displacement, suburbanization, and the like. To help mitigate this issue, Schroeder (2017) proposes a "cascade" approach, wherein DR-TDW is applied backwards decade by decade. The effect is to reduce the temporal distance between the source and target years to its minimum of ten years. Thus, for my dataset, I can first apply DR-AW with 1970 tract data—since 1970 tracts are fully available in my study area—to reallocate 1970 data to 2010 tract geometries. Then, once getting 1970 data into 2010 tracts, I can use that dataset to conduct DR-TDW on 1960 data. Once fully converting 1960 data into 2010 tracts, I can then repeat that step on 1950 data, and so on.

Though good at bringing estimation errors down, cascading DR-TDW still cannot sufficiently capture dramatic population shifts that happen between decades, especially population losses (see Ruther *et al.*, 2015). However, since I have limited my study area to places where 1940 tract data is available, I am able to partially mitigate this potential problem. I can also further reduce errors by making use of HHUUD10. As I mentioned, HHUUD10 provides historical housing unit count estimates in 2010 tract boundaries for each census year from 1940 to the 2015-2019 ACS. It takes a hybrid approach,

employing a customized blend of DR-AW, DR-TDW, and other well-established and novel interpolation methods where most appropriate, which helps to minimize DR-AW and DR-TDW-generated errors (Markley *et al.,* 2022; Appendix A). When combined with housing tenure and occupancy data from historical censuses, HHUUD10 is immediately useful as a way to provide housing unit weights for this study's housing-based variables. But I can also leverage HHUUD10 data to improve my population-based estimates as well.

The Census has historically provided "year structure built" data for housing units. Since it is provided in the target geometries, the process of interpolating housing unit estimates has a major advantage over interpolating population estimates. Indeed, HHUUD10 is constructed using a considerable amount of "year structure built" data. Since *most* census population figures are tied to housing units, HHUUD10 can vastly improve historical population estimates. Specifically, I can use HHUUD10's historical housing unit densities in dasymetric areas—combined with historical housing tenure and occupancy data—as my population reallocation weights rather than relying on area overlaps alone. Assigning tract-level housing unit densities to sub-tract overlap geometries will still require making either AW or TDW assumptions about the intra-tract distribution of housing units, but both a DR-AW-HHUUD and DR-TDW-HHUUD method will respectively produce more accurate estimates than DR-AW or DR-TDW alone. One drawback, however, is that some populations reside in group quarters—like college dormitories, jails, and nursing homes, for example—rather than housing units. But since these populations are relatively small in my study area and since the Census's historical group quarters data has been inconsistently defined (Davern *et al.*, 2009), a

housing weight approach will likely still yield better estimates than the area-based alternatives overall.

Race Variables

A housing unit density-based interpolation method still has a notable shortcoming though. Namely, it assumes all variables are equally correlated with occupied housing unit counts. This can pose a major problem when it comes to calculating variables like racial composition given that the housing landscape remains highly segregated. An extreme example can illustrate this point. Take, for instance, a 1940 tract with 2,000 occupied housing units and 8,000 people. Suppose that the 1,000 housing units in the eastern half of the tract are occupied by white residents and the 1,000 units in the western half are occupied by Black residents. Then suppose that the tract is bifurcated in 1950, making the two new tracts 100 percent white and Black, respectively. Using housing weights to interpolate these populations would incorrectly assume that each of the new tracts was 50 percent white and 50 percent Black.

Additional census data can help correct this. Every census year in the study period contains a *housing tenure by race of householder* variable, allowing me to employ Racial Occupancy Weighting (ROW). With this approach, I can generate a *white* population per *owner-occupied* housing unit variable, a *white* population per *renter-occupied* housing unit variable, a *Black* population per *owner-occupied* housing unit variable, and a *Black* population *per renter-occupied* housing unit variable. After producing these estimates, I can then reallocate each census vintage's racial compositions to 2010 tracts using ROW rather than occupied housing units alone. The result will not be perfect, but I have once

again reduced the estimation error by upgrading my assumption about the intra-tract spatial distribution of the population.[21]

Table A2.1 shows the breakdown of which methods I apply to each census tract vintage. For 1990 and later, I have stated, there is no need to produce my own estimates since the NHGIS has already done so. For 1970 and 1980, the Census released complete tract-level information for all counties in my study area. Therefore, a DR-AW-HHUUD interpolation method can be applied to all source-year tracts. Finally, for 1940 to 1960, complete tract-level data is only available for select counties. For these years, then, DR-AW-HHUUD is only applied to those spaces that were tracted, and DR-TDW-HHUUD is applied to the spaces that were not yet tracted. In all vintages from 1940 to 1980, ROW is implemented for the three race variables.

Table A2.1. Data interpolation method by census year.

Tract-Years	Data Source	Interpolation Method
2010, 2019	US Census, ACS	None; directly from US Census Bureau
1990, 2000	NHGIS	Calculated from NHGIS's time series crosswalk files
1970, 1980	NHGIS, HHUUD10	DR-AW-HHUUD and ROW
1940, 1950, 1960	NHGIS, HHUUD10	DR-AW-HHUUD, Cascading DR-TDW-HHUUD, and ROW

Monetary Variables

After conducting these interpolation procedures, the dataset is about ready for the analysis. There are only two more quirks that need to be addressed. The first is that

[21] The 1950 decennial census does not break housing tenure down by Black-headed households, as all other censuses in the study period do. Rather, it only includes tenure by white and non-white household heads. I therefore use the spatial distribution of the identified non-white-headed households to approximate the spatial distribution of Black-headed households.

median home values, contract rents, and household incomes are not available from the Census for 1960 or 1970. Rather, household monetary values for those years are provided in bins. I thus estimate these variables' median values (m) from the binned values with the following equation:

$$m = l + \frac{\frac{N}{2} - F}{f} r \qquad (A2.1)$$

Here, l is the lower limit of the median value's bin, N is the total number of observations, F is the cumulative number of observations preceding the median value's bin, f is the number of observations in the median value's bin, and r is the range of the median value's bin.

The second quirk is with the 1940 data. In that census vintage, there is no household income variable at all. I thus impute 1940 tracts' median household income (MHI) by fitting a regression on 1950 data, applying that fit to 1940 variables, and then adjusting the output for inflation. The regression model I run is shown in **Equation A2.2**.

$$\log(MHI) = \beta_0 + \beta_1 wht + \beta_2 occ + \beta_3 own + \beta_4 emp + \beta_5 bac + \beta_6 pro + \beta_7 cou + \varepsilon \quad (A2.2)$$

Here, wht is the white population share, occ is the occupancy rate, own is the homeownership rate, emp is the employment rate, bac is the proportion of adults 25 years or older with a bachelor's degree, pro is the proportion of adults employed in a professional field, and cou controls for county fixed effects.

Once these variables are prepared in consistent 2010 vintage tracts, they are ready for the tract-level analysis. However, the variables still must be converted to the HOLC

neighborhood boundaries. For that, I conduct an approach similar to what is described above. Source and target zones are dasymetrically refined, and HHUUD10 data is used to improve area weighting. This additional interpolation step introduces further error to the HOLC grade-level analysis, a cost of aligning this study with previous studies using these geometries. Reporting the tract-level analysis' results in Appendix A helps illustrate what may be lost in this process. With the data now in tracts and HOLC neighborhoods, I can proceed with the analyses.