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An exercise in 'spatial archaeology' identifies vulnerabilities in the layout of the now-notorious Pruitt-Igoe Housing Project, famously demolished in the 1970s, as part of the story.

'Excavating' Pruitt-Igoe using space syntax

Mark David Major

Pruitt-Igoe, in St Louis, Missouri, United States, was one of the most notorious social housing projects of the twentieth century.[1] Charles Jencks argued opening his book *The Language of Post-Modern Architecture*, 'Modern Architecture died in St Louis, Missouri on July 15, 1972 at 3.32 pm (or thereabouts) when the infamous Pruitt-Igoe scheme, or rather several of its slab blocks, were given the final *coup de grâce* by dynamite.'[2] However, the magazine *Architectural Forum* had heralded the project as 'the best high apartment' of the year in 1951.[3] Indeed, one of its first residents in 1957 described Pruitt-Igoe as 'like an oasis in a desert, all of this newness'. But a later resident derided the housing project as 'Hell on Earth' in 1967.[4] Only eighteen years after opening, the St Louis Public Housing Authority (PHA) began demolishing Pruitt-Igoe in 1972 *[1]*. It remains commonly cited for the failures of modernist design and planning.[5]

Literature in both academe and popular media implicates a multitude of factors for the decline of Pruitt-Igoe. It often cites architectural design and urban planning as contributory factors, without specifying how in precise terms. This article uses space syntax to conduct an exercise in 'spatial archaeology' concerning the layout of Pruitt-Igoe to investigate the design and planning of this now-infamous project. What follows will contextualise this exercise in relation to previous findings about social malaise and crime in problematic social housing, and the broader debate about Pruitt-Igoe itself. The purpose is to define if, and how, design and planning were contributory factors in the problems at Pruitt-Igoe, thereby deepening our knowledge about this public housing project. Specifically, the article argues: first, the provision of space (that is, quantity) became a liability with declining occupancy rates; and second, a pattern of 'intelligible dysfunction' characterising the spatial layout implicates the *pilotis* of the residential towers in facilitating opportunities for criminal activity and escape. Both factors fed into what became understood as social malaise at Pruitt-Igoe, contributing to the project's decline and failure.

(Re)introducing Pruitt-Igoe

Pruitt-Igoe was a social housing scheme in north St Louis, Missouri, US. It had thirty-three eleven-storey apartment buildings constructed on a 23-hectare (ha), or 57-acre (ac), site. There were 2,870 apartments to house 13,000 people – 565 people/ha or 228 people/ac – with an average housing density of 125 dwelling units (du) per ha, at the standard American planning definition of High Density Residential (50 du/acre).



1a,b Pruitt-Igoe after 1963 but before 1972 (left) with the Vaughan Public Housing Complex opened in 1957–8 constituting the four branching structures in the foreground at the lower right. And demolition of a Pruitt-Igoe residential tower in 1972 (right).

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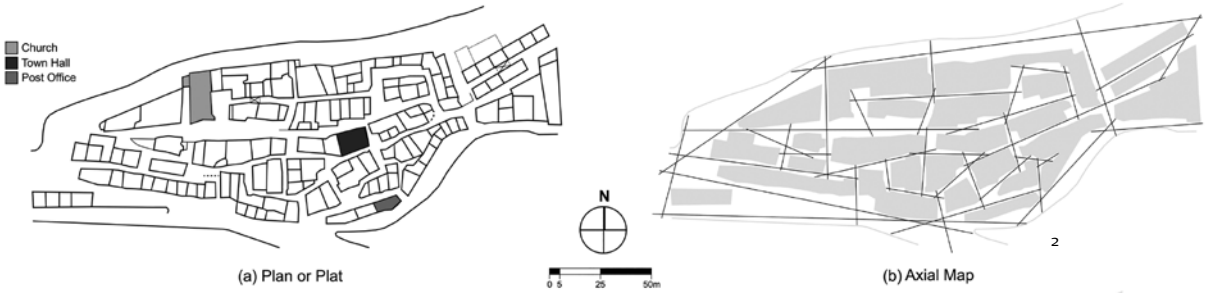
Controversy continued to swirl over the last half-century since its demolition about whether Pruitt-Igoe represented a failure of design and planning, public policy and management, cultural and institutional racism, or all of the above. Scholarly literature extensively investigates, discusses, and identifies many cultural, historical, physical, and political factors complicit in the demise of Pruitt-Igoe.[6] A succinct but bewildering list includes (in alphabetical order): architecture, construction, crime, demographics, design, economy, employment, familial sociology, lighting, maintenance, management, migration, occupancy, policing, politics, public policy, quality assurance, racism, regulations, suburbanisation, urban planning, 'white flight', and (Euclidean or exclusionary) zoning.[7]

At the same time, research into the built environment, crime patterns, and what might be called social malaise has continued to advance our knowledge about postwar social housing. A key takeaway from this research is that the built environment cannot cause crime. It only creates the preconditions for where crime is more likely to occur in terms of statistical probability, not environmental determinism. The outcome is dependent on human action: sometimes it happens and, other times, it does not, depending on a multitude of factors. This literature includes extensive space syntax research on the topic.[8]

Space syntax is an international research programme of academics and practitioners investigating spatial networks scientifically, from the scale of the single building to entire metropolitan regions, to better understand the role of built space in society.[9] Founded in the late 1970s and early 1980s by Bill Hillier, Julienne Hanson, and others at The Bartlett, University College London, space syntax developed a set of techniques for the simple representation – through point, line, convex space, visual field – and measurement of architectural and urban space based on network science using topology *[2]*.[10] Today, the international space syntax community composes hundreds of researchers and practitioners in more than forty countries around the world.

Given these circumstances, it is curious that space syntax researchers have not previously analysed the Pruitt-Igoe Public Housing Project. There are a few reasons:

- First, Pruitt-Igoe no longer exists. Space syntax analysis today can represent only an exercise in spatial archaeology or reconstruction of Pruitt-Igoe. We can model, but not validate using hard data in the form of numbers or graphs based on observed levels of movement and occupation measured and traced across time



2



3

2 Axial mapping in space syntax, based on the longest, fewest, and most strategic lines of line and movement, in modelling the layout of Gassin in the Var region of France, c. 1980.

3 Overhead view of Pruitt-Igoe in 1968 oriented to true north with the Vaughan Public Housing Complex to the lower right.

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4 Satellite view of St Louis in 2017 before construction began on the new National Geospatial-Intelligence Agency headquarters immediately north of the former Pruitt-Igoe site (outlined in white).

4

and space. Instead, we must rely on soft data, which is human intelligence based on opinions, suggestions, and interpretations. There is much circumstantial evidence in archival records and footage about the design, construction, management, and operation of Pruitt-Igoe, as well as the recorded testimony of former residents, public officials, and news reports. This represents a rich reservoir of material for a forensic study, similarly following those using space syntax as an archaeological method over the years.[11] The limitation is that any conclusions will be speculative without recourse to validation in space syntax terms.

- Second, the formal logic of Pruitt-Igoe's layout seems apparent *[3]*. Form and space composed at right angles in the parallel and perpendicular relationships of a regular grid. A problematic plan is not apparent, so it is all too easy to dismiss planning as a factor.
- Third, any researcher studying Pruitt-Igoe is wading into a distinctively American cesspool of racism and ideology that is enough to scare most people away from the topic.[12]

The purpose of this article is straightforward. Can space syntax add anything of value to our knowledge about Pruitt-Igoe? The article investigates the design and planning of Pruitt-Igoe within the urban pattern of north St Louis. The objectives are to: (1) precisely identify the physical factors, if any, that might have been contributory factors to the social malaise at Pruitt-Igoe; and (2) anchor better the physical realm (design, construction, space) to the non-physical realm (policy, management, social) in telling a broader story about Pruitt-Igoe.

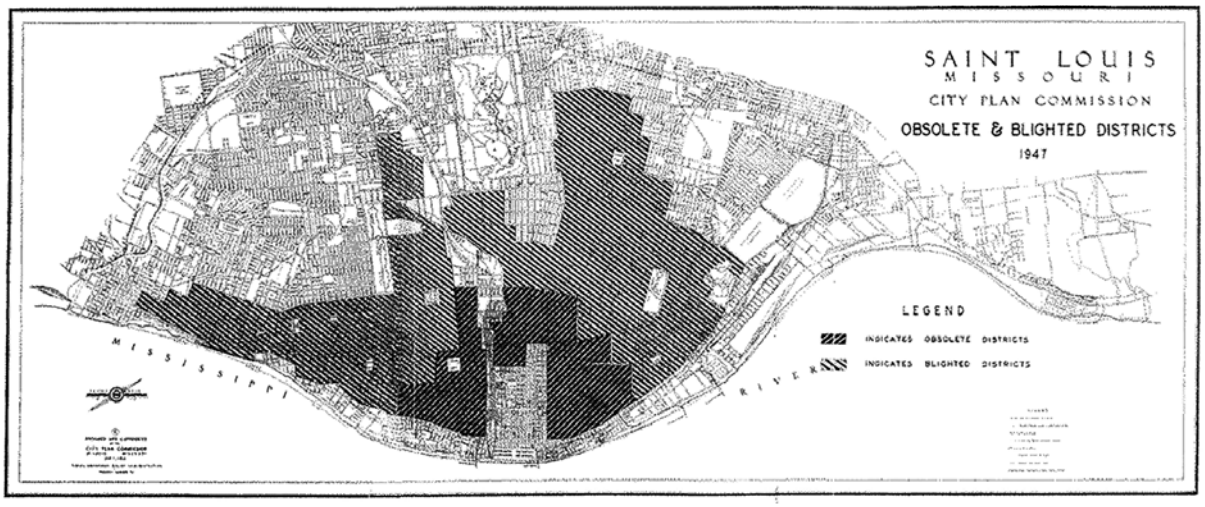
Historical background

Located in the heart of the Mississippi River basin, St Louis and the State of Missouri represent the crossroads of the continental United States. French settlers founded St Louis in 1764, which effectively spent its first four decades as an independent city. Missouri entered the Union as a 'slave state' (which is to say that slavery was permitted) in 1820. Before the annexation of the Texas and California territories in the 1840s, St Louis was the westernmost urbanised area of the country. Missouri did not secede from the Union during the US Civil War. Afterwards, it still bore the political burdens of Reconstruction with the Confederate Southern states – including segregationist policies, that is, separate but equal – of the late nineteenth and early twentieth centuries.

White European immigrants characterised the St Louis population before the First World War. It was the eighth largest city in the United States in 1950 with slightly over 850,000 people. Deformation of offset regular grids was the principal formal planning tool in St Louis before the Second World War, which is still prevalent in the urban pattern today *[4]*.[13] Rail lines running east-west into the city initially fragmented the urban fabric into north and south St Louis. Forest Park, postwar highway construction, riverfront redevelopment, and university campuses later accentuated this north-south divide.

The 1926 Supreme Court decision in *Village of Euclid, Ohio v. Ambler Realty Co.* established zoning as a valid exercise of police power. Euclidean or exclusionary zoning codified architectural modernism in the regulatory regime, later bolstered by the multi-nuclei model of city growth.[14] Land speculators quickly realised the potential

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5 Obsolete and blighted areas designated, in dark and light grey hatching respectively, in the 1947 Comprehensive Plan for the City of St Louis.

financial windfall of converting inexpensive agricultural tracts into valuable urban land uses in the suburbanisation of city peripheries, especially with road infrastructure catering to the automobile.[15] The 1956 Federal-Aid Highway Act accelerated this process. At the same time, urban renewal policies of the 1949 National Housing Act, promoted slum clearance and replacement with concentrated high-rise public housing (or Title I housing) for economic development purposes.[16] Consequently, cities could legally designate large tracts of urban fabric as obsolete or blighted. It was a necessary step to initiate compulsive purchases (or eminent domain), demolish housing stock in older neighbourhoods, aggregate smaller lots into larger ones, and secure Federal funding for projects like Pruitt-Igoe.[17] For example, the 1947 Comprehensive Plan for the City of St Louis designated nearly half of the city as obsolete or blighted *[5]*.

Many cities of the US northeast and midwest, characterised by declining industry, ageing factories, and falling populations, bear the scars of these postwar policies, which did not account for massive demographic changes occurring during the early-to-mid twentieth century. St Louis was one of many to experience an influx of economically vulnerable populations to city centres. By 1950, black Americans comprised 17.9% – 7.9% above than the national average at the time – and white Americans 82% of the St Louis population. Black American population increases focused in areas of north St Louis, east St Louis, Alton, and Wood River on Illinois Metro-East, and the 1894 incorporated city of Ferguson, Missouri.[18] At the same time, policies of the 1949 National Housing Act, mortgage discrimination, and restrictive covenants facilitated 'white flight' to the suburbs, excluding black Americans and other ethnic minorities.[19] Over time, these processes left behind economically vulnerable black Americans in city centres with declining populations, a dwindling tax base for basic services, and fewer opportunities for employment. It led to a pattern of racial re-segregation in American cities, which endures in places like St Louis today.[20]

Setting the stage for an exercise in spatial archaeology

Advances in computer science over the last half-century led to the extensive mapping of economic vulnerability, ethnic demographics, and different types of crime such as property burglary and vandalism, or personal assault and robbery.[21] This article focuses narrowly on two aspects of crime: perception and opportunity. Scholars like Oscar Newman, in *Defensible Space*, appear to confuse perception and opportunity for several reasons.[22] First, effective management and formal/natural policing can mediate for opportunity to varying degrees. By natural policing, we mean 'eyes on the street' in the everyday use of space – people in movement and static use of space, front doors and porches, and so on – as defined by Jane Jacobs and others.[23] Formal policing includes security guards, police patrols, closed-circuit television (CCTV), or video surveillance, and so forth. Natural policing seems inherently more effective in terms of prevention and resources.[24] Second, a perception of crime might arise even if there is little evidence for specific types of crimes.[25] In this case, perception can be both a leading indicator *and* reflect the reality of an underlying problem. Third, opportunity and perception can sometimes merge into creating the most dangerous of urban conditions. The latter does not always happen, but some of the worst examples occurred in postwar modernist social housing. Pruitt-Igoe is only one example. Generally, crime patterns – multiple incidents on average, not individual acts – occur based on three spatial variables: (1) less-used spaces that are quiet enough for a crime to occur undisturbed; but (2) used enough that subjects of crime are present; and (3) proximate to highly-used spaces to facilitate escape. In space syntax terms, this means somewhat segregated or deep spaces somewhat near to integrated or shallow spaces, but not necessarily

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adjacent in Cartesian terms.[26] Hillier and Sahbaz also found residential burglaries related to the number of du/street segment – and, by implication, front doors distributed between street intersections – controlling for the variable of the spatial network using space syntax.[27] It comes down to the 'risk and reward' nature of crime for opportunity, action, and escape.

Another discovery of previous space syntax research was a 'broken interface' between moving adults and static children (two-to-one or less on average), which characterised some spaces of postwar modernist social housing. When adults did pass through such spaces they correctly perceived them as being dominated by children, especially teenagers (that is, under 18 years old). Namely, modernist planning disrupted the typical proportion (twelve-to-one on average) found in nearby more traditional, street-oriented urbanism where there would be many more adults than children. This was an explicit objective of modernist design and planning, creating protected green spaces and separating different types of movement and use. The results were that adults under-used and under-supervised some spaces during everyday use.[28] Unsupervised children, especially teenagers, perpetrated petty vandalism such as graffiti and broken lighting, which fed perceptions of social malaise. Disabled exterior and interior lighting became a frequent complaint of residents *vis-à-vis* their personal safety in places like Pruitt-Igoe.[29] Unused space became abused space. However, perception did not always necessarily match reality. In one example in the UK, almost all reported crimes were not major ones but petty vandalism, noise complaints, and domestic disputes.[30] In any case, a perceived or real worsening of conditions can exacerbate the situation, for example a shift towards fewer adults and even more children/teenagers in some spaces. Situations like this can reach a tipping point where opportunity and perception merge. Unused and abused space then becomes understood by people as dangerous, which can exacerbate the situation.

Did this happen at Pruitt-Igoe? The circumstantial evidence is intriguing.[31] Former residents appear to distinguish between three different spatial experiences at Pruitt-Igoe. They are generally positive about family life inside the apartments before 1968. Initially, they were positive about the public corridors/communal areas and negative about the stairwells/elevators, but discussions of both evolve into negatives in relation to deferred maintenance and social malaise. Finally, former residents are mostly silent about the ground level exterior spaces in the 1950s but overwhelmingly negative during the 1960s. Their testimony makes clear there were many unsupervised children and teenagers at Pruitt-Igoe. They discuss developing a specific code of conduct – frequently using the phrase 'be a man' – for life at the ground level. They even noticed stark differences outside of the housing project, even if only across the street. The quantity of unsupervised children/teenagers in the background of archival photography and video footage showing the Pruitt-Igoe exterior spaces is startling, especially during the 1960s.

This seems authentic even when allowing for the attractor effect of cameras and accounting for the potentially manufactured nature of some footage *[6]*. For example, most adult photographers and camera operators departed when finished, but the children and teenagers remained behind at Pruitt-Igoe. It suggests there might have been a broken interface between adults and children at Pruitt-Igoe. Did the layout of Pruitt-Igoe possess the characteristics to generate such a thing? If so, why did it initially seem of little importance but later of considerable significance to the Pruitt-Igoe residents? The article will attempt to offer some answers.

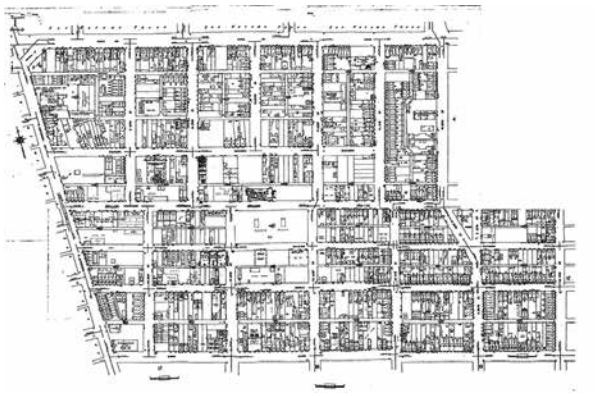
Before Pruitt-Igoe: Desoto-Carr neighbourhood

Many low-income black Americans lived in the DeSoto-Carr neighbourhood before the construction of Pruitt-Igoe. Nineteenth-century tenements characterise much of St Louis, including DeSoto-Carr.[32] These tenements deteriorated between the 1920s and 1940s *[7]*. Many were overcrowded. Some did not have running water. Others had communal facilities with shared kitchens and bathrooms. Many owners ('slumlords') profited on the number of



6 Children playing on an abandoned car in Pruitt-Igoe in the late 1960s.

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7a,b

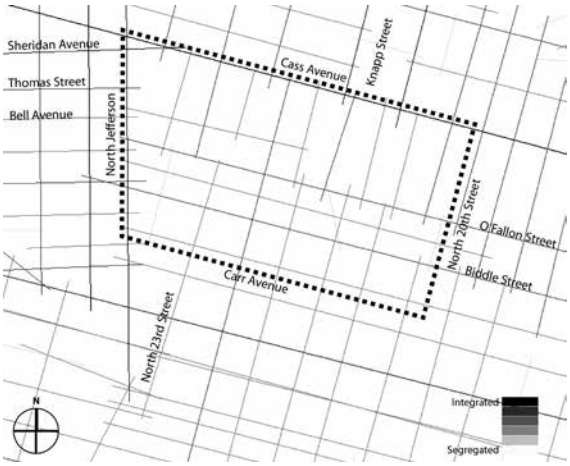
renters but did not maintain the properties. The city also did not enforce basic property maintenance on these owners.[33] City authorities proposed the redevelopment of an inner ring of historic neighbourhoods around the central business district (CBD) of downtown St Louis based on slum clearance and replacement with high-rise, high-density public housing.

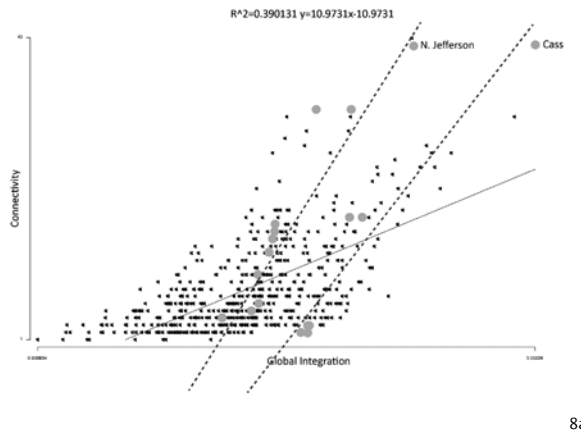
In hindsight, several factors bring into question the justification for slum clearance at the time. First, density was not a distinguishing feature of Pruitt-Igoe, being only slightly higher than existing conditions. Public authorities had to replace the demolished tenements. Its appeal was quality, not quantity. Second, there were similar tenements in white neighbourhoods of south St Louis. In the postwar period, property owners rehabilitated these tenements of gentrified neighbourhoods such as Soulard or Tower Grove into some of the most attractive places to live in the city today. Tenements in south St Louis were also subject to slum clearing policies over the years. Some remain in jeopardy today. However, black neighbourhoods in north St Louis seem to have borne a disproportionate share of property demolitions. Third, property owners and public authorities may have exaggerated the extent of deterioration to facilitate access to Federal funds.

Public authorities constructed Pruitt-Igoe with Federal funds at a cost of +/-$36 million dollars (or $12,500/du) in 1954. It is unclear what this cost included or excluded. Costs could have been higher, shuttled between the different city, state, and Federal budgets. If exclusive to the housing, then Pruitt-Igoe would cost $360 million (or $125,000/du) in today's monetary terms.[34] This cost/du is low but still feasible to renovate a St Louis tenement today. If we prescribe a more generous $200,000/du cost, this would rehabilitate 1,800 tenements or 69% of Pruitt-Igoe's capacity at its historic peak occupancy (91%) in 1957. It would represent 78 more tenements than a 60% occupancy rate at Pruitt-Igoe. On the surface, these factors seem to undercut the long-term effectiveness of urban renewal policies that gave rise to slum clearance and public housing solutions like Pruitt-Igoe. However, public authorities did not consider tenement rehabilitation as a viable option for DeSoto-Carr.

7a,b Future Pruitt-Igoe site of the Desoto-Carr neighbourhood in the 1938 Sanborn Map (left); and a nineteenth-century tenement building at Jefferson Avenue and Biddle Street in 1952 demolished to make way for Pruitt-Igoe (right).

8a,b Space syntax model of global integration (radius = n) in the DeSoto-Carr neighbourhood (left); with the future site of Pruitt-Igoe outlined (dotted black line); and, intelligibility scatter (global integration vs connectivity) (right), indicating two intelligible subsystems governed by Cass Avenue and N. Jefferson Avenue, respectively, due to the grid logic in this part of north St Louis in 1933. Please note, dotted lines in the scatter are not correlation lines, but for visual reference only.





8a,b

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Streets with higher interconnectivity to the east/south than north/west characterised the DeSoto-Carr layout within the north St Louis urban pattern before Pruitt-Igoe [8]. A 1933 US Geological Survey map serves as the baseline map for space syntax modelling of north St Louis in this study. Information about alleyways – extensive in older residential areas of St Louis – is unavailable. However, alleyways usually run parallel to public right of way, so they tend to only reinforce the pattern of the main street network in space syntax terms. There is grid deformation to the north/west and grid expansion to the south/east of the site.[35] Employment opportunities before the Second World War were to the south and east at the Union Station rail yards and riverfront port/rail/warehouse facilities, respectively. Moderate-to-lowly integrated streets (in light grey and white-ish) composed the site.

Collectively, this makes sense. The future Pruitt-Igoe site was primarily a residential area. The functional 'heart' of the future Pruitt-Igoe site was on the edge at the northwest corner intersection of North Jefferson Avenue (N. Jefferson) and Cass Avenue (Cass), which were and are seam streets between three gridiron sections in this part of north St Louis. N. Jefferson extends north-to-south from Hebert Street (three blocks from Natural Bridge Avenue) to Washington Avenue, continuing far into south St Louis along a different alignment. Cass extends east-to-west from the riverfront (or nearly so) to Grand Avenue. It is also a street-level segment of State Highway 80 connecting further west to Page Boulevard. Inside the site itself, there were twelve north-south streets, two continuing further north and four to the south, and only four east-west streets, three continuing further east and only one to the west. All intersect at right angles except one short street connecting at about 27° to another. There were fifty-eight segments, all part of longer streets except three, which were merely short streets connected at either end. There were no cul-de-sacs. Based on the 1938 Sanborn Map of the site, there was a minimum of 730 street-oriented dwelling entrances on the future Pruitt-Igoe site, but probably more (refer back to Figure 7).[36] This represents 12.6 dwelling entrances per street segment (or 6–7 tenements on either side of a double-loaded street segment) and 45.6 per street (or 22–3 tenements on either side of a double-loaded street).[37]

Despite the simplistic formal order of only sixteen streets in an offset regular grid layout, there was a sophisticated spatial logic to the neighbourhood. There were distinctive, multilayered 'intelligible' subsystems governed by Cass and N. Jefferson in the intelligibility relationship between connectivity and global integration, that is, what you have access to immediately on a street and further away in the broader urban context [8b].[38] One was associated with N. Jefferson, Carr Avenue, and access to the east/south and the other with Cass and access to the north. Also, there were unconnected subsystems associated with the intelligibility of parallel streets, which is dependent on street length. It is elegant evidence for the instrumental power of the regular grid to generate subtle differentiations in the urban spatial network, despite its strong prescriptive formal order.[39]

Public authorities intended Pruitt-Igoe as a symbol of postwar housing and urban renewal policies. They could have hardly chosen a more strategic site in north St Louis for this purpose. Due to its contextual relationships, the Pruitt-Igoe site 'wants' to be intelligible. A designer would have to go out of their way to make this site unintelligible in space syntax terms. There is no evidence the architects or public authorities were attempting to do so. If anything, they did not appreciate the spatial resilience of the site's contextual relations, overvaluing its symbolic power as a location at the expense of undervaluing its instrumental power in the functioning of the north St Louis urban grid. In part, it is critical for understanding the vulnerabilities in the design and planning of Pruitt-Igoe.

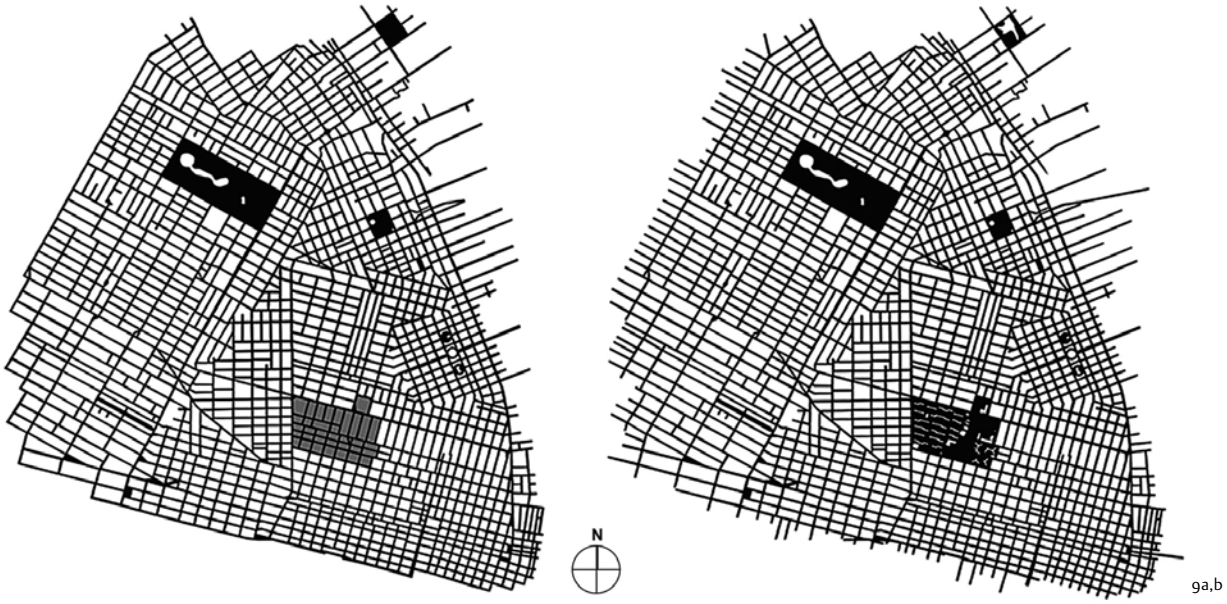
Pruitt-Igoe: design and planning vulnerabilities

The initial proposal for the site – a mix of high-rise, mid-rise, and street-oriented residential buildings – was acceptable to city authorities. However, it exceeded the Federal cost limits of the St Louis PHA, which imposed a uniform building height at eleven floors. The approved plan incorporated modernist design and planning principles, including stripped-down aesthetics for high-rise buildings and the siting of buildings to free the ground level for green spaces, circulation (for example, *pilotis*), and the intrusion of natural light.[40,41] The effect was the spatial layout at Pruitt-Igoe bore a stronger resemblance to the 1908 Fairground Park to the northwest than to the rest of the north St Louis urban pattern [9]. It also included the rationalisation of land uses and the separation of pedestrians and vehicles. The bounds of the site were Cass to the north, N. Jefferson to the west, Carr Avenue to the south, and North 20th Street to the east. The site plan incorporated the pre-existing St Stanislaus Catholic Church and School at the eastern edge [10a]. The future Vaughan Public Housing Complex (opening in 1957–8) was adjacent to the site in the southeast. Diagonally opposite in the northeast was Blewett Middle School, which still operates today.

Deformation of 'smallish' regular grids is a characteristic of the St Louis urban pattern.[42] It informed the planning of Pruitt-Igoe as well. The siting of buildings followed the geometry of the pre-existing street network in DeSoto-Carr. However, the location of retained buildings seemed to most define the land use logic with these non-residential uses loaded towards the interior of the larger interstitial area at the eastern edge of Pruitt-Igoe, some distance away from N. Jefferson and Cass.

Space syntax can help us to see past this geometric logic by using the most optimal line of sight and movement passing through every space until accounting for a minimum of all potential routes, including diagonalising across the formal geometry of the plan. It includes the *pilotis* passageways, which we reconstruct based on the paving plan and available historic photographs of Pruitt-Igoe. The *pilotis* at the base of each Pruitt-Igoe residential tower only partially 'liberated' the ground level. There were

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9a,b

9a,b Before and after figure-ground representation (space in black, blocks in white) of the north St Louis urban pattern before 1933 (left) with the future site of Pruitt-Igoe highlighted in grey; and after 1958 (right), showing the buildings of the Pruitt-Igoe and Vaughan social housing. This map also represents the bounds of the space syntax model of north St Louis used in this study.

two circulation routes available at ground level via the *pilotis* of each tower, with approximately 50% of the building mass anchored to the ground *[*10b, and 1 refers*]*. The *pilotis* provided access to the interior of each tower via stairwells and elevator: one elevator and three stairwells in each with stairwell usage split into separate wings. All dwelling entrances previously oriented to streets elevated in section to the internal corridors of the high-rise towers. The threshold of stairwells and elevators (132 in all) at ground level were the 'front doors' of Pruitt-Igoe, all oriented inward to the building and not outward to the public space. Of course, they were not really front doors, representing the elimination of all residential front doors at ground level on the site.

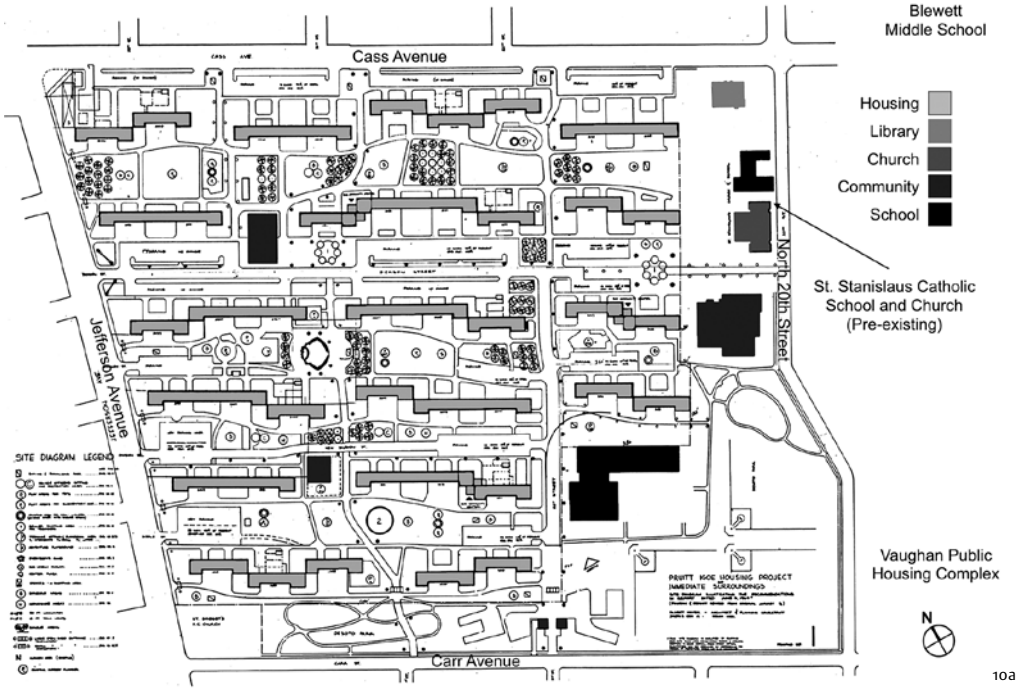
We reconstructed these *pilotis* passageways on the following basis. First, if it looks like a line of sight and movement might sneak through, then it probably did since a line has no width in the real world. This consistently occurs at <5° parallel to exterior walls of the towers. Second, we ignore changes in elevation due to landscaping. There appeared to be a few examples at Pruitt-Igoe, but none too drastic. Third, the Vaughan social housing also used 'cut-through' passageways at ground level. Crucially, they were separate from the entries to the Vaughan tower blocks, some of which endured until 2006. Residents could avoid them. This was not the case in Pruitt-Igoe. Historical photographs and building footprints are clear about the location of these Vaughan 'cut-through' routes *[*1 refers*]*. The initial results of the space syntax analysis of Pruitt-Igoe's layout starkly contrasts with the straightforward, formal geometric logic of the immediate surroundings *[*11a*]*.

Generally, most residents and scholars agree that a problem in the design of the Pruitt-Igoe high rises was the inclusion of 'skip-stop' elevators, which only provided access to the first, fourth, seventh, and tenth floors of the eleven-storey buildings.[43] Most residents had to use dark stairwells primarily designed as fire exits to access the floors of their dwelling units *[*11*]*. The testimony of former residents indicates these stairwells and elevators were a problem from the beginning.[44] In themselves, they were not the issue. Rather, that was the access to them facilitated by the ground-level *pilotis*, which was uncontrolled and publicly accessible. Crucially, the *pilotis* mediated between formal access and spatial distribution from inside to outside and *vice versa*. Stairwell usage provided a small but regular traffic of residents in quiet spaces where a crime could occur. The *pilotis* also offered immediate access to many routes at ground level. It made it easy to 'disappear' at Pruitt-Igoe, especially as occupancy rates declined and damaged exterior lighting went unrepaired.

Some people must have quickly realised and acted on these opportunities. Intensive patrols of the grounds and buildings began soon after Pruitt-Igoe opened in the 1950s. These security measures faltered as conditions worsened during the 1960s. Emergency services effectively abandoned Pruitt-Igoe as too hostile of an environment for employees. Residents would vent their frustrations whenever these public servants did manage to respond to a call. Criminal activity spread from the stairwells to the elevators and then, to the communal galleries/corridors. According to Bristol, 'forced to walk through the galleries to reach their apartments, residents were threatened and attacked by gangs, who used these spaces as hangouts. Residents were also frequently attacked in the elevators.'[45]

Planning also played a role. There were ninety-two distinct spatial routes (+575%) in the Pruitt-Igoe layout, when before there were only sixteen in the DeSoto-Carr street network. This appears to have

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10a

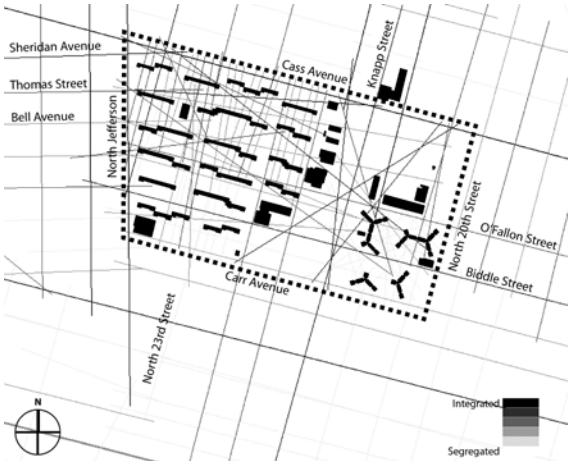
10a,b Original site plan of Pruitt-Igoe, left, indicating land uses in greyscale colour-coding (a few buildings/'as-built' footprints were not constructed as shown in original site plan); and, below ground-level view of a residential tower *pilotis* at Pruitt-Igoe before demolition in 1972 showing the views through at ground level.

imbued a sophisticated 'intelligible dysfunction' to the spatial structure, layering multiple vulnerabilities for opportunity and escape in the housing project due to the *pilotis*. As before, there were two intelligible subsystems in the north and south, demonstrating the spatial resilience of the site [12]. However, N. Jefferson and Cass were no longer the most connected routes. Site planning pushed them into the higher ranges of global integration due to the separation of pedestrians and vehicles. Instead, the Pruitt-Igoe layout internalised and heightened connectivity within the tower blocks on a series of diagonals and gridlines (or segments thereof) for pedestrians, parking, and green spaces, which distinguished N. Jefferson and Cass as perimeter streets primarily for vehicular flows in the spatial structure.

Crucially, this meant N. Jefferson and Cass did not govern these intelligible subsystems. Internal diagonal routes from Cass Avenue to Thomas Street and the Vaughan social housing principally governed the northern subsystem. Thomas Street and



10b

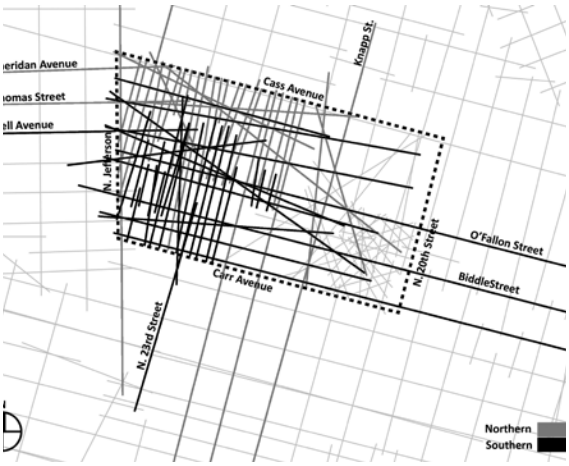


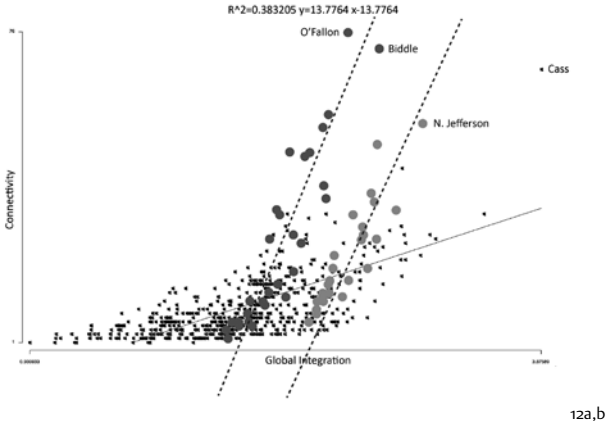


11a,b

11a,b Space syntax model of global integration (radius = n) for Pruitt-Igoe in north St Louis c. 1958 (left); and interior view of a Pruitt-Igoe stairwell, date unknown (right). Please note that some lines of sight and movement in Pruitt-Igoe are so segregated (in very light grey) in the space syntax model that they are barely discernible in the image to the left.

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12a,b

12a,b Map (left) and intelligibility scatter (right) of the routes composing the northern (in grey) and southern (in dark grey) subsystems of Pruitt-Igoe in north St Louis circa 1958. Please note that dotted lines in the scatter are not correlation lines, but for visual reference only.

N. Jefferson were part of this subsystem, but formally adjacent at its perimeter. The east-west gridline routes (O'Fallon Street and Biddle Street, which became the most connected routes) from the riverfront, passing through the Vaughan and Pruitt-Igoe social housing to terminate at/near N. Jefferson, principally governed the southern subsystem.

This 'internalisation' of connectivity is important. The vertical scale of the Pruitt-Igoe tower blocks was disproportionate to the surrounding area [1 refers]. Because of their scale in elevation and the limited liberation from the ground via the *pilotis*, they probably operated like 'walls' in the urban fabric. The *pilotis* afforded enough visibility to facilitate formal access to the stairwells/elevators, but insufficient visibility to facilitate comprehensive surveillance of people at the ground level.

The two intelligible subsystems account for every route in Pruitt-Igoe. Routes composing the northern subsystem passed through, adjacent to, or terminated on the façades of twenty-seven of the thirty-three (or 70%) residential towers in Pruitt-Igoe. Routes composing the southern subsystem did so for every residential tower. Nine large-scale diagonal/gridline routes passing through, terminating within, or on façades of the Vaughan social housing also facilitated access to every residential tower in Pruitt-Igoe. Every one of these routes connected through Pruitt-Igoe to terminate at Cass (2) or N. Jefferson (7).[46] It seems to demonstrate how the spatial structure (the geometric layout and *pilotis* passageways, in particular) generated an easy to read and use layout for formal access (opportunity) and spatial distribution (escape) in criminal activity throughout Pruitt-Igoe, especially to and from the south.

On the other hand, it is perplexing how a well-connected, intelligible layout on a strategic site like Pruitt-Igoe generated a broken interface between adults and children, as previously detected by space syntax researchers in other problematic social housing. However, there is circumstantial evidence for a broken interface based on the soft data, for example, resident testimony and archival footage. The most reasonable explanation is the layout did not generate a broken interface, at least not in terms of spatial structure. We must look elsewhere for an answer.

The value of co-presence

Population and demographics seem to offer the best answer most consistent with the available evidence, timeline, testimony of former residents, and spatial analysis. Specifically, declining occupancy rates generated the broken interface between adults and children in the ground-level exterior spaces at Pruitt-Igoe. It helps explain why the ground-level spaces initially seemed of little importance to the residents in the 1950s and later of great significance during the 1960s. The occupancy rate peaked at 91% in 1957, after which it declined. Sources differ about how quickly depopulation occurred at Pruitt-Igoe. According to Ramroth, the occupancy rate was 67% in 1965.[47] According to Newman, after a certain point, the occupancy rate never rose above 60%.[48] Sometime between 1957 and 1965, occupancy declined to a level that increasingly exposed the planning vulnerabilities in the Pruitt-Igoe layout, meaning it would not necessarily be a problem if enough people had lived there, especially adults.

Space began to play a secondary, contributory role as a dependent variable. It was due to the: (1) provision of space, that is, quantity; and (2) structure of space, that is, more expansive *and* segregated nature of the intelligible southern subsystem compared to the northern one, especially related to the Vaughan social housing. There were too few people (especially adult males who belonged there), too many unsupervised children, and too much space. It indicates the innate value of co-presence in the built environment.[49] In this, three factors seemed critical for Pruitt-Igoe. There is already extensive research on two factors: regulatory failure and racism. These factors were 'baked-in' problems from the beginning of Pruitt-Igoe, which the article briefly summarises below. A third factor seems overlooked: the end of large-scale construction with the opening of the Vaughan Public Housing Complex.

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First, regulatory failures skewed the demographics of Pruitt-Igoe. Lower-income families led by a work-age, unemployed male head of household could not receive government assistance or placement in public housing at the time. Employees of the St Louis PHA actively advised low-income families how to circumvent the rules, that is, the husband could leave the family and State of Missouri.[50] Then, the female-led household could secure government assistance and housing. Projected outward across multiple households, this significantly reduced the number of adult males living at Pruitt-Igoe. At the same time, St Louis PHA was inflexible about rule enforcement, even implementing night-time inspections to ensure husbands were not living with their families at Pruitt-Igoe.[51] Overall, this increased the proportion of females and children residing at Pruitt-Igoe. These demographic characteristics worsened as the St Louis PHA shuttled the most economically vulnerable populations, who could not secure placement in other public housing, into Pruitt-Igoe during the 1960s.

Second, a 1955 Federal court order to desegregate St Louis public housing undercut occupancy and maintenance at Pruitt-Igoe. It is impossible to envision alternative scenarios to this court order that would have been legally feasible and morally tolerable at the time. It is a fundamental problem of racism: viable solutions require its absence.[52] Accurate data about occupancy at Pruitt-Igoe is unavailable, so demographic data is virtually non-existent. However, the testimony of black residents is consistent. White residents fled Pruitt-Igoe after the court order. Beyond the obvious, it indicates two things. White residents had more housing choices and employment opportunities to relocate elsewhere.[53] Because of this, white residents were probably the most reliable source of rental income, which funded maintenance at Pruitt-Igoe. St Louis PHA premised its Pruitt-Igoe maintenance budget and schedule based on a 100% occupancy rate, contrary to best management practices. It meant maintenance was 'behind the curve' from the beginning at Pruitt-Igoe since its peak occupancy rate was 91%. The loss of this rental income effectively ended regular maintenance. Many former residents cite property maintenance of common areas as a factor in the decline of Pruitt-Igoe.

Third, large-scale construction on the site and immediate vicinity ended with the opening of the Pruitt Elementary School and Vaughan Public Housing Complex circa 1957–8. Seven decades later, it is difficult to ascertain exact construction schedules. The grand opening of Pruitt-Igoe was 1954. According to a local newspaper, the first families moved into Pruitt-Igoe in July 1955. Sources differ about construction continuing for the residential towers until 1955 or 1956. The only date associated with the Pruitt Elementary School and Vaughan social housing is 1957. It is unclear if this is a construction or opening date. It is possible there was onsite/adjacent construction until the beginning of 1958, perhaps even 1959. The early success that residents attribute to Pruitt-Igoe and its peak occupancy rate coincide with these four or five years.

It is intriguing for a few reasons. The constant presence of male construction workers in the area may have initially aided natural policing of the space. These construction workers may have also assisted the St Louis PHA with maintenance during the early years. Some Pruitt-Igoe residents might have also benefited (directly or indirectly) from employment opportunities associated with construction in the area. It is not definitive, but signs of social malaise at Pruitt-Igoe seemed to gather pace after the end of construction in the area.[54] It suggests the potential benefits of co-presence by more adults (especially males) who were supposed to be there – if only temporarily during the day – for the natural policing of space.

Over time, occupancy rates declined, construction ended, the number of adults (especially males) who belonged there decreased, and the proportion of children in female-led households increased, who grew up to become teenagers *[13]*. Unsupervised children and teenagers participated in petty vandalism, that is, graffiti, damaged lighting, and so on. There is ample photographic evidence of graffiti at Pruitt-Igoe.[55] The forthright testimony of former residents as children growing up in Pruitt-Igoe ('we



13 There are two children/teenagers for every adult in this photograph, including the background, at Pruitt-Igoe in the late 1960s.

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did some crazy things') makes clear that elevators, stairwells, and light fixtures were frequent targets of petty vandalism.[56] The perception of social malaise began a vicious cycle. Fearful for their safety, adult females probably limited their space use as much as possible to the interior spaces of the buildings (for example, apartments, corridors/communal areas) and into-and-out movement quickly from the residential towers/housing project to the surrounding context, that is, stairwells/elevators, then perimeter streets. Absent adults – 'disappeared' males, employed or apartment-bound females – meant a higher number of unsupervised children in the ground-level exterior spaces of Pruitt-Igoe. Again, the testimony of former residents is informative.[57] People with nefarious intentions at Pruitt-Igoe frequently paid unsupervised children to serve as lookouts during their activities. There were also many males at Pruitt-Igoe, who did not live or belong there. They came to Pruitt-Igoe from outside the community to prey on the residents, especially economically vulnerable females.

Collectively, the opening date and creation of nine large-scale diagonal/gridline routes – some via 'cut-through' passageways – passing through, terminating within, or at the edge of the Vaughan social housing seems problematic. All these routes composed part of the intelligible subsystems, facilitating escape from the housing of Pruitt-Igoe. Criminal activity does not tend to occur in housing areas where the perpetrators live.[58] They export their activities to nearby areas. Pruitt-Igoe had a spatially asymmetrical relationship (meaning unequal) with the nine-storey buildings at Vaughan in terms of formal access, vertical scale, and horizontal size. There is insufficient criminal or demographic data to explicitly implicate the Vaughan Public Housing Complex in the social malaise of Pruitt-Igoe. However, its adjacent location and the circumstantial evidence of the space syntax analysis seem compelling.

If the *pilotis* had been originally designed as – or later converted into – enclosed lobbies secured by key access limited to only Pruitt-Igoe residents and management, it might have eliminated the problems with the stairwells. It would have also simplified subsequent actions such as security patrols of the ground-level spaces. The spatial analysis of the layout without the *pilotis* (and Vaughan 'cut-through') passageways is a little messy but intelligible in space syntax terms. It is a functional layout: neither bad nor great. There is more explicit stratification in levels of connectivity between the diagonals/gridline routes and the rest of the housing project. It suggests a broken interface between adults and children might have still emerged, especially in the southern housing areas of Pruitt-Igoe due to population decline and skewed demographics. However, at the very least, it could have assisted in forestalling social malaise at Pruitt-Igoe. Instead, the uncontrolled *pilotis* seemed to play a contributory role in facilitating its onset.

Conclusion

Pruitt-Igoe was one of the most comprehensive social housing disasters of the twentieth century that implicates almost every facet of the modern world: cultural, design, institutional, policy, political, management, and planning. Much of the controversy surrounding Pruitt-Igoe involves attempts to pinpoint a single factor for its decline and fall. Different people approach the story of Pruitt-Igoe from diverse personal and academic perspectives. They tend to provide different answers, usually dependent on their specialties, but also often fundamentally related to other factors. The built environment and people who live in it are the factors that seem best able to anchor the multitude of issues surrounding Pruitt-Igoe in the real, physical world. This article was limited to inferring a great deal based on archival information about Pruitt-Igoe. The circumstantial evidence implicated a series of design and planning features as contributory factors, directly or indirectly, in the social malaise of Pruitt-Igoe. The provision of space – the quantity – in the layout became a liability as occupancy rates declined. Intelligible dysfunction in the spatial layout implicated the *pilotis* feature of the residential towers in facilitating opportunity and escape in criminal activity, mainly due to the contextual relation to the Vaughan Public Housing Complex. In turn, all contributed to the perception *and* reality of social malaise at Pruitt-Igoe, and its eventual decline and demolition.

Notes

1. Social or public housing is affordable housing constructed and managed by government (local, State or Federal in the US) for the most economically vulnerable in society, that is, lower- and lower-middle income. 'Housing project' or 'the projects' are American colloquial terms for social housing. 'Housing estate' or 'the estate' are the British equivalent.
2. Charles Jencks, *The Language of Post-Modern Architecture* (New York: Rizzoli, 1977), p. 9.
3. [n.a.], 'Slum Surgery in St. Louis', *Architectural Forum*, 94 (April 1951), 128–36.
4. C. Freidrichs and J. Freidrichs, *The Pruitt-Igoe Myth* (documentary) (Oxford Film Festival: 11 February 2011, 79 minutes). There is more information available at <http://www.pruitt-igoe.com/> [accessed 5 March 2021].
5. Ted Kitchen and Richard H. Schneider, *Crime Prevention and the Built Environment* (New York and London: Routledge, 2007); See also: W. G. Ramroth, *Planning for Disaster: How Natural and Man-made Disasters Shape the Built Environment* (Chicago: Kaplan Publishing, 2007); Peter Hall, *Cities of Tomorrow: An Intellectual History of Urban Planning and Design in the Twentieth Century* (Hoboken, NJ: Wiley, John & Sons Inc., 2004); L. K. Weisman, *Discrimination by Design: A Feminist Critique of the Man-Made Environment* (Urbana and Chicago: University of Illinois Press, 1994); Tom Wolfe, *From Bauhaus to Our House* (New York: Farrar, Straus & Giroux, 1981); Oscar Newman, *Defensible Space; Crime Prevention Through Urban Design* (Washington, DC: DIANE Publishing, 1973).
6. [n.a.], 'Why the Pruitt-Igoe Housing Project Failed', Prospero: Books, Arts and Culture Blog, *The Economist*, 15 October 2011, available online <http://www.economist.com/blogs/prospero/2011/10/americanpublic-housing> [accessed 2 March 2016];

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see also: E. Birmingham, 'Reframing the Ruins: Pruitt–Igoe, Structural Racism, and African American Rhetoric as a Space for Cultural Critique', *Western Journal of Communication*, 63:3 (September 1999), 291309 <DOI: 10.1080/10570319909374643>; K. Bristol, 'The Pruitt–Igoe Myth', *Journal of Architectural Education*, Association of Collegiate Schools of Architecture, 44:3 (May 1992), 163–71; R. Montgomery, 'Pruitt–Igoe: Policy Failure or Societal Symptom', *The Metropolitan Midwest* (Urbana and Chicago: University of Illinois Press, 1985).

7. 'White flight' refers to the large-scale migration of people of various European ancestries from racially mixed urban regions to more racially homogeneous suburban or exurban regions. The origins of the term in the mid-twentieth century are unclear. *Merriam-Webster Dictionary* cites first usage in 1967.
8. Ramroth, *Planning for Disaster*; see also: Newman, *Defensible Space*; Bill Hillier and Ozlem Sahbaz, 'An Evidence-Based Approach to Crime and Urban Design, Or, Can We Have Vitality, Sustainability and Security All At Once?' (2008), available online <https://spacesyntax.com/wp-content/uploads/2011/ 11/Hillier-Sabbaz_An-evidence-based-approach_o 10408.pdf> [accessed 2 March 2016]; Mark David Major, Alan Penn, Bill Hillier, 'The Urban Village and City of Tomorrow Revisited', in *Second International Space Syntax Symposium Proceedings* 2, ed. by F. de Holanda, L. Amorim, F. Dufaux (1999), pp. 48.01–48.18; Simon Shu and Bill Hillier, 'Housing Layout and Crime Vulnerability', in *Second International Space Syntax Symposium Proceedings* 1, ed. by F. de Holanda, L. Amorim, F. Dufaux (1999), pp. 25.01–25.12; Bill Hillier, *Space is the Machine: A Configurational Theory of Architecture* (Cambridge: Cambridge University Press, 1996); Julienne Hanson and Bill Hillier, 'The Architecture of Community: Some New Proposals on the Social Consequences of Architectural and Planning Decisions', *Architecture and Comportement, Architecture and Behaviour*, 3:3 (1987), 251-73; Bill Hillier, 'City of Alice's Dreams', *The Architects' Journal* (9 July 1986), 39–41.
9. Hillier, *Space is the Machine*; see also: Mark David Major, *The Syntax of City Space: American Urban Grids* (New York and London: Routledge, 2018); Julienne Hanson, *Decoding Homes and Houses* (Cambridge: Cambridge University Press, 1998); Bill Hillier, Julienne Hanson, *The Social Logic of Space* (Cambridge: Cambridge University Press, 1984).
10. Ibid.; see also: Alastair Turner, Maria Doxa, Patrick O'Sullivan, Alan Penn, 'From Isovists to Visibility Graphs: A Methodology for the Analysis of Architectural Space', *Environment and Planning B: Planning and Design*, 28:1 (2001), 103–21; Bill Hillier, Alan Penn, Julienne Hanson, Ted Grajewski, Jiaming Xu, 'Natural Movement: Or, Configuration and Attraction in Urban Pedestrian Movement', *Environment and Planning B: Planning and Design*, 20:1 (1993), 29–66; Bill Hillier, Ricky Burdett, John Peponis, Alan Penn, 'Creating Life: Or, Does Architecture Determine Anything?', *Architecture et Comportement/Architecture and Behaviour*, 3:3 (1987), 233–50; Bill Hiller, Julienne Hanson, H. Graham, 'Ideas are in Things: An Application of Space Syntax Method to Discovering Housing Genotypes', *Environment and Planning D: Planning and Design*, 14:4 (1987), 363–85; M. L. Benedikt, 'To Take Hold of Space: Isovists and Isovists Fields', *Environment and Planning B: Planning and Design*, 6:1 (1979), 47–66.
11. J. Bermejo Tirado, 'Aplicaciones de Sintaxis Espacial en Arqueología: Una Revisión de Algunas Tendencias Actuales', *Arqueología de la Arquitectura*, 12:e031 (2015). See also: Jason S. Shapiro, 'A Space Syntax Analysis of Arroyo Hondo Pueblo, New Mexico', *School of American Research Press*, Santa Fe, New Mexico, Arroyo Hondo Archeological Series (2015), available online <http://www.arroyohondo.org/publications/monographs/space-syntax-analysis-arroyo-hondo-pueblo-newmexico> [accessed 8 July 2020]; S. G. Morton, M. M. Peuramaki-Brown, P. C. Dawson, J. D. Seibert, 'Civic and Household Community Relationships at Teotihuacan, Mexico: A Space Syntax Approach', *Cambridge Archaeological Journal*, 22:3 (2012), 387–400; Wendy Bustard, 'Space, Evolution and Function in the Houses of Chaco Canyon', in *First International Space Syntax Symposium Proceedings* 2, ed. by M. D. Major, L. Amorim, F. Dufaux (1997), pp. 23.01–23.21; Jason S. Shapiro, 'Fingerprints on the Landscape: Cultural Evolution in the North Rio Grande', in *First International Space Syntax Symposium Proceedings* 2, ed. by Major, Amorim, Dufaux, pp. 21.01–21.21.
12. The author is one of the leading space syntax experts in the world, who was born in 1967 and raised in south St Louis about 8 km (5 miles) from the Pruitt-Igoe Housing Complex. This combination of experience and 'local' knowledge provides the (perhaps unique) perspective necessary to conduct space syntax analysis of Pruitt-Igoe.
13. Major, *The Syntax of City Space*; see also: Mark David Major, 'The Invention of a New Scale: The Paradox of Size and Configuration in American Cities', *Journal of Space Syntax*, 6:1 (2015), 170–91; Mark David Major, 'The City's Essential DNA: Formal Design and Spatial Processes in the Urban Pattern', *Journal of Space Syntax*, 4:1 (2013), 160–4.
14. Major, *The Syntax of City Space*; see also: Andres Duany, Elizabeth Plater-Zyberk, Jeff Speck, *Suburban Nation: The Rise of Sprawl and the Decline of the American Dream* (New York: North Point Press, 2000); C. Harris and E. Ullman, 'The Nature of Cities', *Annals of the American Academy of Political and Social Science*, 242 (1945), 7–17.
15. Ibid.
16. Simultaneously, its financing mechanisms incentivised mass-produced housing developments in the suburbs.
17. Ana Cláudia Castilho Barone, 'Harland Bartholomew and Racially Informed Zoning: The Case of St. Louis', *Revista Brasileira de Estudos Urbanos e Regionais*, 20:3 (2018), 437–56.
18. C. Gordon, *Mapping Decline: St. Louis and the Fate of the American City* (Philadelphia: University of Pennsylvania Press, 2009).
19. K. M. Kruse, *White Flight: Atlanta and the Making of Modern Conservatism* (Princeton, NJ: Princeton University Press, 2007). See also: W. Thabit, *How East New York Became a Ghetto* (New York: New York University Press, 2003); L. Pulido, 'Rethinking Environmental Racism: White Privilege and Urban Development in Southern California', *Annals of the Association of American Geographers*, 90:1 (2000), 12–40.
20. See, for example: 'Racial Dot Map: One Dot Per Person for the Entire U.S', maps by Dustin A. Cable and available from the Weldon Cooper Center for Public Service at the University of Virginia based on 2010 US Census data, available online <https://demographics.virginia.edu/DotMap/index.html> [accessed 5 March 2021].
21. Gordon, *Mapping Decline*; see also: Hillier and Sahbaz, 'An Evidence-Based Approach to Crime and Urban Design'; Shu and Hillier, 'Housing Layout and Crime Vulnerability'.
22. Newman, *Defensible* Space.
23. Jane Jacobs, *The Death and Life of Great American Cities* (New York:

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Random House, 1961); see also: Duany, Plater-Zyberk, Speck, *Suburban Nation*; Hillier, *Space is the Machine*; Hanson and Hillier, *The Social Logic of Space*; Jan Gehl, *Life Between Buildings: Using Public Space* (1987, 2011 rev. edn, London: Island Press, 1971); William H. Whyte, *City: Rediscovering the Center* (Philadelphia: University of Pennsylvania Press, 1981).

24. Ibid.
25. Hillier, 'City of Alice's Dreams'; see also: Major, Penn, Hillier, 'The Urban Village and City of Tomorrow Revisited'; Shu and Hillier, 'Housing Layout and Crime Vulnerability'.
26. Shu and Hillier, 'Housing Layout and Crime Vulnerability'.
27. Hillier and Sahbaz, 'An Evidence-Based Approach to Crime and Urban Design'.
28. Hillier, *Space is the Machine*; see also: Major, Penn, Hillier, 'The Urban Village and City of Tomorrow Revisited'; Shu and Hillier, 'Housing Layout and Crime Vulnerability'.
29. Shu and Hillier, 'Housing Layout and Crime Vulnerability'; see also: Freidrichs and Freidrichs, *The Pruitt Igoe Myth*, Unicorn Stencil Films (2011).
30. Major, Penn, Hillier, 'The Urban Village and City of Tomorrow Revisited'.
31. Freidrichs and Freidrichs, *The Pruitt Igoe Myth*.
32. A tenement is an attached, semi-detached, or detached multi-family residential dwelling where an owner holds the land and rents the dwelling and/or rooms to an end user.
33. Lawrence H. Larsen and Richard S. Stewart, *A History of Missouri: 1953 to 2003* (Columbia: University of Missouri Press, 2004), p. 60.
34. Based on inflation as of 2015.
35. Major, *The Syntax of City Space*.
36. The Sanborn Map shows the building footprints. Only small lot, residential dwellings with minimal street setbacks are included in this estimate, which excludes vacant lots, alleyway-accessed buildings, residential dwellings with deep street setbacks, residential plots, and large (probably non-residential) buildings.
37. These estimates cannot account for vacant residences at the time.
38. We use Intelligibility (correlation between the space syntax measures of connectivity and global integration) for this analysis due to fewer, longer, and more connected streets in American cities, which are shallower with less differentiation for topological depth in space syntax terms; See also, Major, *The Syntax of City Space*. Intelligible subsystem means a set of related spaces, which crosses over the slope of correlation into the higher ranges of both measures within the larger urban context.
39. Ibid.; see also: Albert Pope, *Ladders*, Architecture at Rice 34 (New York: Princeton Architectural Press, 1996).
40. The *pilotis* in modernist architecture uses support piers, which raises the architectural volume, freeing the ground for circulation under the building, and providing a sense of floating or lightness in the architecture itself.
41. Le Corbusier, *The City of Tomorrow and Its Planning*, trans. by F. Etchells (1987 edn, New York: Dover Publications, 1925). See also: Walter Gropius, *The New Architecture and the Bauhaus* (rev. edn 1965, Cambridge, MA: MIT Press, 1923).
42. Big for European cities but small for American ones in relative terms; see also: Major, 'The Invention of a New Scale'.
43. 'Skip-stop' elevators use cantilevered floor plates to minimise floor area, which reduces cost for concrete pours and associated mechanical equipment. According to data cited by MIT, the total all-inclusive costs of 'skip-stop' elevators are 30% lower than stopping on all floors.
44. Freidrichs and Freidrichs, *The Pruitt Igoe Myth*.
45. Bristol, 'The Pruitt–Igoe Myth', p. 357.
46. One exception terminated only a block away at the intersection of Elliot Avenue and Gamble Street.
47. Ramroth, *Planning for Disaster*.
48. Newman, *Defensible Space*.
49. Duany, Plater-Zyberk, Speck, *Suburban Nation*; see also: Hanson and Hillier, 'The Architecture of Community'; Jacobs, *The Death and Life of Great American Cities*.
50. They tended to move across the river to east St Louis, Illinois.
51. Freidrichs and Freidrichs, *The Pruitt Igoe Myth*.
52. The *St. Louis Post-Dispatch* heralded Pruitt-Igoe as the 'first integrated public housing' for black and white lower- and lower-middle class families in the city. This was misleading, referring to the site and not the housing. Black residents lived in the Pruitt Homes and white residents in the Igoe Homes.
53. Affordable housing became increasingly available in the city as 'white flight' to the suburbs gathered pace during the 1950s. From 1950 to 1960, city population decreased by 12.5%. By the 1970s, it decreased another 17% (Source: US Census Bureau).
54. It does not mean that city authorities could have 'built their way out' of the issues at Pruitt-Igoe. Any benefits for Pruitt-Igoe and its residents would tend to dissipate as construction sites shifted further away from the area.
55. The Research Center of the State Historical Society of Missouri at the University of Missouri-St Louis (UMSL) collects, preserves, publishes, exhibits, and makes available material that focuses on preserving the diverse history of the city and its surrounding area within a statewide context. The photo database consists of nearly 177,000 records and 41,000 images. Many historic photographs of the DeSoto-Carr neighbourhood and Pruitt-Igoe Public Housing Complex are available in the UMSL Photo Archive. However, it is not always clear who took the original images under what circumstances.
56. Freidrichs and Freidrichs, *The Pruitt Igoe Myth*.
57. Ibid.
58. Hillier, *Space is the Machine*; Hanson and Hillier, *The Social Logic of Space*; Hillier, 'City of Alice's Dreams'.

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Competing interests
The author declares none.

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