BUILDINGS & CITIES

Architectural form: flexibility, subdivision and diversity in Manhattan loft buildings

RESEARCH

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ABSTRACT

How do the design and spatial configuration of buildings impact the economic life of their neighbourhood? A mixed-methods study of industrial loft buildings in the Midtown Garment District of Manhattan in New York City investigates both occupants and built forms over a long period (1930–80). A large-scale statistical analysis of flexibility shows how the tenants' space requirements in those buildings changed and how the buildings were able to respond through flexibility in the subdivision and arrangement of rooms or suites occupied by different tenants. The research is anchored around the physical and economic analysis of two sets of buildings (n = 37) divided according to whether buildings supported consistently high or consistently low diversities of tenants of varying economic specialisations over time. These loft buildings were found to support an economic diversity of businesses (*i.e.* many collaborating specialisms in the garment industry) that expand or contract according to business conditions. From the analysis of these buildings, an array of six physical parameters is derived that influence the capabilities of buildings to consistently support high levels of diversity of tenants over extended periods of time.

PRACTICE RELEVANCE

This research shows that the physical characteristics (design and layout) of buildings affect their capabilities to accommodate a variety of different tenants, allowing for a rapid expansion or contraction of individual tenancies. This flexibility provides economic robustness for the building because it can respond to changing tenant needs and economic conditions. The design decisions involving cores, corridors, facades, light and air have economic impacts that were not previously recognised. They emerge here as critical elements in the fine-grained relationship between the physical and economic dynamics of the city.

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1. INTRODUCTION

Do the physical parameters of the built environment play a role in shaping the economic fabric of the city? Does the way in which we shape our buildings impact the building-scale economic fabric, its diversity and its inclusivity in the short and long terms? These questions are examined in this paper.

This paper is part of a broader ongoing project analysing the relationship between the physical and the economic fabrics of the Midtown Garment District of New York City from 1930 to 1980. A glimpse into any moment within this time period reveals several thousands of people, businesses, organisations, *etc.*, maintaining a foothold within this pocket of the urban fabric. In 1934, for instance, there were 13,294 such listings composed of: (1) economic firms, *e.g.* specific garment manufacturers, textile importers, button and zipper wholesalers, *etc.*; (2) organisational entities, *e.g.* labour unions, religious assemblies, therapy groups, social clubs, *etc.*; and (3) residents and households living in the area.

Within this portion of the building stock, a key research question is: Whether and how did the built environment influence localised economic diversity and inclusivity throughout the lifespan of the buildings?

A clarification of terminology used in this paper is now provided.

- *Shapes*
  This paper investigates an array of physical building characteristics and their impact on the diversity of the economic fabric at the building scale. These characteristics were observed to influence the likelihood of certain dynamics of economic inclusivity and diversity taking place. To be clear, this is not an if–then equation, not a monocausal relationship being put forth. Indeed, such relationships are not readily observed within rigorous analyses of the indeterminate nature of the city, and the complexities of the relationships between the physical and the economic layers therein (Judkins *et al.* 2008: 27–28).
- *The economic fabric of a city*
  The deeply interconnected web formed by the network of tenants, businesses, firms, organisations, groups, clubs, *etc.*, that support ranges of critical functions and roles within the city.
- *The built environment*
  This text is written with the ordinary urban building in mind: the residential, commercial, mixed-use buildings that comprise the majority of the urban fabric, not the civic or monumental structures.

Based on the author's literature reviews, little evidence was found to answer this question with due depth. The present paper appears to be the first to delve down to the building scale to investigate an array of built-world characteristics that exert a causal influence over the densities of economic diversities supported inside a building in the short and long terms.

1.1 BACKGROUND

A noteworthy breadth of literature investigates the relationships between the built environment and various social, political, economic and cultural layers of society. The literature reviews conducted for this research began at the urban scale, mapping the following domains of scholarship in order to attempt to situate this investigation within the contours of related discourses. These initial literature reviews were focused upon:

- Environment–behaviour theory: anchored around the seminal works of Jacobs (1961), Holzner *et al.* (1967), Alexander *et al.* (1977), Peet (1985), Kostof (1991, 1992), Brand (1994) and Davis (2012, 2019).
- Space syntax: anchored around the seminal works of Hillier & Hanson (1984) and Hillier (1999).
- Communication theory and reception theory: anchored around the seminal works of Lynch (1960), Rapoport (1988), Vale (1992) and Amin (2016).

- Urban morphology: anchored around the seminal works of Conzen (1968, 2001), Sargent (1972), Whitehand (1977, 1988), Ford (1985), Siksna (1997), Whitehand & Morton (2003) and Tsukamoto *et al.* (2008).
- Generative-planning theory: anchored around the seminal works of Moholy-Nagy (1957), Alexander *et al.* (1977), Alexander (1987), Rapoport (1988) and Oliver (1997).
- City-size theory: anchored around the seminal works of Burgess *et al.* (1925), Christaller (1966), Berry (1964) and Fletcher (1986, 1995).

At these larger scales, perhaps the most comparable domain of scholarship tends to fall within the umbrella of urban morphology, specifically within texts investigating the relationship between urban street/block patterns and the subject of urban vibrancy, a topic often tied to the seminal work of Jane Jacobs (Li *et al.* 2020: 2–3). Some recent efforts within this domain include the works of Li *et al.* (2020), Long & Huang (2019), Wu *et al.* (2018) and Ye *et al.* (2018), among others.

For brevity, this paper of course cannot delve into each of these discursive domains and texts in detail. However, what these urban-scale literature reviews unveil is that the specific question underpinning this paper remains in critically untapped territory:

> *Does the way in which we shape our buildings impact the building-scale economic fabric, its diversity and its inclusivity?*

Some of the literature is relevant to this question. Jacobs (1961: 227–229) offers some insight into the matter of how diversities of building heights, sizes and ages can help to support diversities of uses in finding footholds within an urban locality. Alexander *et al.* (1977) also frames some avenues in the subject, focusing on building- and urban-scale patterns and their relationship to various societal dynamics. Hillier & Hanson's (1984) work is also worth underscoring, specifically due to its focus on how the built environment can help shape dynamics of movement and social organisation across scales. Brand (1994) focuses on the editability (or lack thereof) of the various layers of a building and offers a glimpse into how initial decisions of materiality and sectional considerations can impact a building's porosity to varied levels of transformation over time. Davis (2012, 2019) sheds light on the critical functions supported by mixed-use and live–work typologies within the city, and the physical–economic relationships that can be leveraged in order to support the potential revitalisation of manufacturing/production within the city.

In the context of Manhattan's Midtown Garment District and the nature of the urban industrial loft building, there are some further texts to underscore, specifically the work of: Dolkart (2011: 14), who focuses on the large-scale 'industrial lofts and office and showroom buildings' of the Midtown Garment District; Bruegmann (1997: 210), who focuses on the large-scale loft buildings of the urban fabric of Chicago, *i.e.* 'the workhorse[s] of the nineteenth-century city'; as well as Steadman (2014: 238), who briefly notes some of the intricacies of these large-scale deep-plan loft buildings, *i.e.* those 'simple, utilitarian, undecorated structures that filled their sites'.

These latter texts help to situate the architecture–historic narrative of the urban loft building typology and its relationship to urban industry. However, they do not address the question of concern underpinning this research.

Based on the intensive literature reviews conducted by the author, there does not appear to be a singular piece of scholarship that rigorously delves into the scale of the individual building (or intra-building) and extracts replicable architectural parameters that help to shape the diversity and inclusivity of the building-scale economic fabric. The weight that architecture at the building scale exerts upon localised economic diversity remains an open question.

1.2 HISTORICAL PRECEDENTS

Within the realm of historic precedent, the paucity of the discourse is once more underscored, for two reasons. First, historic precedents are few and far between, often noted in texts as mere footnotes of curiosity. Second, within the available precedents, the dominant means through which the built world is often documented as supporting localised economic diversity is through the maintenance of derelict built-world conditions in proximity to higher quality conditions—with the derelict supporting lower economic echelons of society, and the higher quality conditions supporting higher echelons.

Derelict spaces support conditions one would neither want to replicate due to basic issues of health, safety, dignity and human rights, nor are they ones which could be replicated within most cities today due to the presence of rigorous building and urban codes.

Nonetheless, these precedents are worth noting. They are some of the few examples that shed light on how the built world can influence diversity and inclusivity at the building scale.

How this takes place can be broken into two categories: buildings exhibiting horizontal incorporation of diversity and those exhibiting vertical incorporation of diversity.

One example of horizontal diversity is the late 19th- and early 20th-centuries German housing projects known as the Mietskasernen (Kostof 1992: 118). Here, two different types of housing conditions are framed: (1) the sun-lit, more spacious, more luxurious conditions on the peripheral street front, supporting tenants from higher socioeconomic echelons; and (2) the dimly lit, lower quality, courtyard-facing apartments, with some courtyard widths as narrow as 4.5 m, supporting tenants from lower socioeconomic echelons, aggregated. Here, the manipulation of building-scale parameters leads to variations in demographics being supported on site, specifically building massing, courtyard patterns, unit sizes, unit quality, and the quality of light and air.

Another example of horizontal inclusivity is found in the European burgage plots of the Middle Ages, which supported diversities of uses on their narrow-yet-deep sites. In the pre-industrial era, these lots supported a European mercantile house typology. A live–work condition occupied the primary street front, while partial agricultural production as well as subsidiary economic functions took root within the deeper portions of the site (Kostof 1991: 148). A different kind of diversity took shape within these plots with the onset of the Industrial Revolution and the increased demand for urban housing. The agricultural portions of the burgage plots were replaced with high-density housing, transforming the lot typologies into a manner resembling the Mietskasernen noted above. They began to support lower socioeconomic echelons within the more interior portions of their sites and higher socioeconomic echelons around their street-front peripheries. Here, once more, one observes the creation of derelict versus better-quality built-world conditions in close proximity to one another (Kostof 1991: 149).

An example of verticalised integration of diversity is the multistorey version of the aforementioned European mercantile housing typology. The higher echelons inhabited the first storey above the street level (*piano nobile*), and increasingly lower echelons were observed as one ascended or descended the building, with the poorest lodgings in the poorly conditioned garret or basement spaces (Kostof 1992: 118). This dynamic was observed within 18th- and 19th-centuries New York City, with servants' quarters often occupying the attic or cellar spaces of the three-storey Dutch townhouse typology, while the higher socioeconomic residences occupied the middle portions of said buildings (Lepore 2005: 71–75). These attic and cellar spaces were also noted to support smaller scale and informal manufacturing enterprises during this period (Day 1999: 13). A similar verticalised inclusivity was also observed in 20th-century European apartment blocks, with stories above the *piano nobile* increasingly supporting lower socioeconomic demographics, as one travelled to higher floors (Kostof 1992: 118). The modernist architect and urbanist Le Corbusier first gained a foothold within 'one of the most lovely streets of St. Germain-des-Prés' in Paris by living in a poorly conditioned former servants' quarters in the attic level of such a building typology (Weber 2008: 129–131). Intriguingly, had the young Le Corbusier sought a foothold in the elder Le Corbusier's utopian visions for the city of the 21st century, he would not have been able to find such inclusive typologies in the built environment.

The dilemma is that the conditions being framed are ones that neither should, nor often in fact could, be replicated within the contemporary city. And while this will be shown in detail below, it is important to reassure readers beforehand that the built-world parameters that are discussed in this paper are not ones that create such zones of dereliction. They are parameters that behave in a much more fine-grained manner, opening up the building stock towards increased economic diversities, yet without compromising basic issues of health, safety, dignity and human rights.

1.3 ECONOMIC DIVERSITY

Before proceeding any further, however, there is a critical point to clarify with regard to economic diversity. Is this paper making the normative statement that buildings *should* support higher economic diversities? Or inversely, that buildings *should not* support lower diversities?

The diversification of a city's economic portfolio, across both scales and functions, plays a critical role in the long-term resilience of the urban economic fabric (Malizia & Ke 1993; Templet 1999; Dissart 2003; Komarek & Loveridge 2014). Such diversity, however, can be achieved in a range of ways.

Consider, for instance, two clusters of buildings. The first cluster is composed of low-diversity buildings supporting internal economic monocultures, *e.g.* one building supporting solely dress manufacturers, another solely textile importers, another hat-box makers, another button suppliers and another textile dyers. The second cluster in turn is composed of high-diversity buildings supporting internal economic polycultures, *e.g.* each building supporting a diverse composition of dress manufacturers, textile importers, hat-box makers, button suppliers and textile dyers (the same functions as in the first series).

The first cluster would be assessed as having low diversities at the building scale, but high diversities at the cluster scale. The second cluster would be marked as having high diversities at both the building and cluster scales. The key, however, is that if both clusters of buildings were assessed in the aggregate, they would be noted as supporting the same levels of economic diversity.

Given that it is this diversification of the urban fabric that is the objective of urban economic resilience, no such normative assertion can be made whether or not this diversity *should* be produced at the building scale.

The building scale is simply the fundamental scale of interest to this research. Can this scale play a critical supportive role in the fine-grained diversification of the urban economic fabric, or is this economic dynamic only negotiable at larger scales? This is the topic being addressed here.

2. METHODS

This paper is part of an ongoing mixed-methods research project looking at the Midtown Garment District of Manhattan over the period 1930–80. This research started during the author's doctoral research (2012–17), and subsequently entered a second phase of research and analysis from 2019.

Quantitative data were collected for 1934, 1942, 1958, 1963 and 1973. Initially, the aim was to collect data over exact 10-year increments starting with 1930; however, the availability of useable datasets required certain adjustments to be made. For each of the year-sets, the details of the entire physical and economic fabric of the Midtown Garment District were documented and coded: the physical metrics of all buildings and the economic specifics of all tenants, arriving at a cumulative total of 2280 buildings and 53,493 tenants.

The economic specialisations of the tenants were coded through primary sources, specifically reverse-business directories in microfiche format via the New York Public Library and Library of Congress. A total of 1345 distinct specialisations were catalogued, *e.g.* infant wool dress manufacturers, Japanese silk importers, paper hat-box manufacturers, garment-tag manufacturers, zipper wholesalers, dress-manufacturing unions, social clubs, *etc.*

A range of real estate agents, property managers and architects were also engaged via anonymised informal conversations and email exchanges throughout the research process. The oral conversations were not directly recorded, but rather recollected and transcribed afterward into field notes. A total of six real estate agents, eight property managers, seven landlords, three architects and two structural engineers were engaged via this process. All these confidential informants chose to remain anonymous, noting the complex and competitive nature of urban development and real estate in Manhattan as the main cause for their hesitancy of speaking with their identities made public.

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From the obtained physical and economic datasets, a metric for measuring building-scale economic diversity was established, coined *the density of economic diversity*. This was calculated as the number of tenants of different economic specialisations listed in a building divided by the building's gross floor area.

Using the density of economic diversity, the building stock of the area was evaluated according to performance: whether they supported high or low densities of economic diversity. Fifteen buildings were consistently in the top quintile of performers for the year-sets examined (1934, 1942, 1958, 1963 and 1973); and 22 were consistently in the lowest quintile. The high performers consistently supported 10 or more different specialisations per 10,000 ft^2 (929 m^2) of gross floor area for each year examined; and the low performers consistently supported less than two specialisations per 10,000 ft^2 (929 m^2) of gross floor area for each year examined. Due to the signing of several non-disclosure agreements within the research process, the specific addresses of the buildings studied cannot be revealed.

The research project sought to investigate whether there were common architectural, physical or spatial characteristics that were consistently shared amidst the higher performers and consistently absent within the lower performers. Six such characteristics emerged, which are discussed in the following section.

3. RESULTS

The research question being examined was whether certain building-scale characteristics were consistently observed in the higher performing set of buildings and simultaneously consistently absent in the lower performing set. Six characteristics emerged, including:

- core placement and design
- communal corridor layout and design
- building size
- facade rhythm
- access to light and air
- southern exposure on the street front.

Note that all the buildings studied underwent several changes of property managers and building owners throughout the course of their lifetimes, as expected in a real estate market such as Manhattan. The economic behaviour therefore cannot be attributed to anomalous idiosyncrasies of ownership or management.

Tables 1 and ***2*** show the more-consistent presence within the higher performing buildings, and the absence within lower performing buildings, of these parameters. The higher performing set of buildings coincide with buildings 1–15; the lower performing with buildings 16–37. For brevity, a limited number of buildings are used below to frame the parameters in more depth. Important to note, however, are that the characteristics are not anomalies to the visualised cases herein, but rather observed throughout the 37 buildings analysed.

Table 1: Presence ('Yes') or absence ('No') of specific physical attributes in higher performing buildings.

BUILDING NUMBER	ASYMMETRIC CORE PLACEMENT	UNIFIED COMMUNAL CORRIDOR	< 16,000 GROSS SQUARE FEET	INCREMENTAL FACADE RHYTHM	MORE THAN MINIMUM ACCESS TO LIGHT AND AIR	SOUTHERN EXPOSURE ON STREET FRONT
1	Yes	Yes	Yes	Yes	Yes	Yes
2	Yes	Yes	Yes	Yes	Yes	Yes
3	Yes	Yes	Yes	No	Yes	No
4	Yes	Yes	Yes	Yes	No	Yes
5	Yes	Yes	Yes	No	No	No
6	Yes	Yes	No	Yes	Yes	No

(contd.)

BUILDING NUMBER	ASYMMETRIC CORE PLACEMENT	UNIFIED COMMUNAL CORRIDOR	< 16,000 GROSS SQUARE FEET	INCREMENTAL FACADE RHYTHM	MORE THAN MINIMUM ACCESS TO LIGHT AND AIR	SOUTHERN EXPOSURE ON STREET FRONT
7	Yes	Yes	Yes	Yes	Yes	Yes
8	Yes	Yes	No	Yes	No	No
9	Yes	Yes	Yes	Yes	No	Yes
10	Yes	Yes	No	Yes	Yes	Yes
11	Yes	Yes	Yes	Yes	Yes	Yes
12	Yes	Yes	Yes	Yes	Yes	Yes
13	Yes	Yes	Yes	Yes	Yes	Yes
14	Yes	Yes	Yes	No	No	No
15	Yes	Yes	Yes	Yes	Yes	No

BUILDING NUMBER	ASYMMETRIC CORE PLACEMENT	UNIFIED COMMUNAL CORRIDOR	< 16,000 GROSS SQUARE FEET	INCREMENTAL FACADE RHYTHM	MORE THAN MINIMUM ACCESS TO LIGHT AND AIR	SOUTHERN EXPOSURE ON STREET FRONT
16	No	No	No	Yes	Yes	No
17	No	No	No	Yes	Yes	No
18	No	Yes	No	Yes	No	Yes
19	Yes	No	Yes	No	No	Yes
20	Yes	Yes	No	No	Yes	No
21	No	No	No	No	No	Yes
22	No	No	No	Yes	Yes	Yes
23	No	No	No	Yes	Yes	Yes
24	No	Yes	No	No	Yes	No
25	No	Yes	No	Yes	No	No
26	Yes	No	Yes	No	No	Yes
27	No	Yes	Yes	No	Yes	No
28	No	No	No	No	No	Yes
29	No	No	No	Yes	No	Yes
30	No	No	No	No	Yes	No
31	No	Yes	No	No	Yes	Yes
32	Yes	No	No	No	No	No
33	No	No	No	No	No	No
34	No	No	No	Yes	Yes	No
35	No	Yes	Yes	No	No	Yes
36	No	No	No	Yes	Yes	Yes
37	No	Yes	No	Yes	Yes	No

Table 2: Presence ('Yes') or absence ('No') of specific physical attributes in lower performing buildings.

3.1 ASYMMETRIC CORE PLACEMENT

Of the buildings examined, 100% of the higher performing buildings contained asymmetrically placed cores, compared with 18% in the lower performing set.

This strategy entailed offsetting the core by approximately 20–30 ft (6.0–9.1 m) from the street front and pushing it to one side of the floorplate. For smaller building typologies, pushing the core to the side of the floorplate is a design strategy often born out of necessity. Particularly for buildings situated within lots of narrow widths (*e.g.* the typical 20–25 × 98 ft (6.0–7.6 × 30.5 m) lots of Manhattan), this is one of the few approaches that allows for minimum circulation and egress widths to be satisfied, particularly when the various mechanical, electrical, plumbing, janitorial, storage, *etc.* functions adjacent to the core are taken into consideration.

Offsetting the core with this kind of specificity from the street front, however, seems counterintuitive. One would assume, given the depth of conventional Manhattan lots, that the preference would be to set the core further back into the floorplate, maximising the rentable area on the street front. This approach, however, was not commonly observed. In the higher performing set, for instance, the core was offset from a low of 20 ft (6.0 m) to a high of 34 ft (10.4 m) from the street front.

Architectural historian Carol Willis points to a real-estate rule of thumb that clarifies the reasoning here: having 'shallow, better-lit space' is preferable to 'deep and therefore dark interiors' in the higher demand street front, and diminishing rental returns have been historically observed after around 25 ft (7.6 m) of well-lit space (Willis 1995: 26). This was also corroborated in anonymised conversations with real estate agents in the Midtown Garment District during the course of this research.

Three examples of this asymmetric core placement are illustrated in ***Figure 1***.

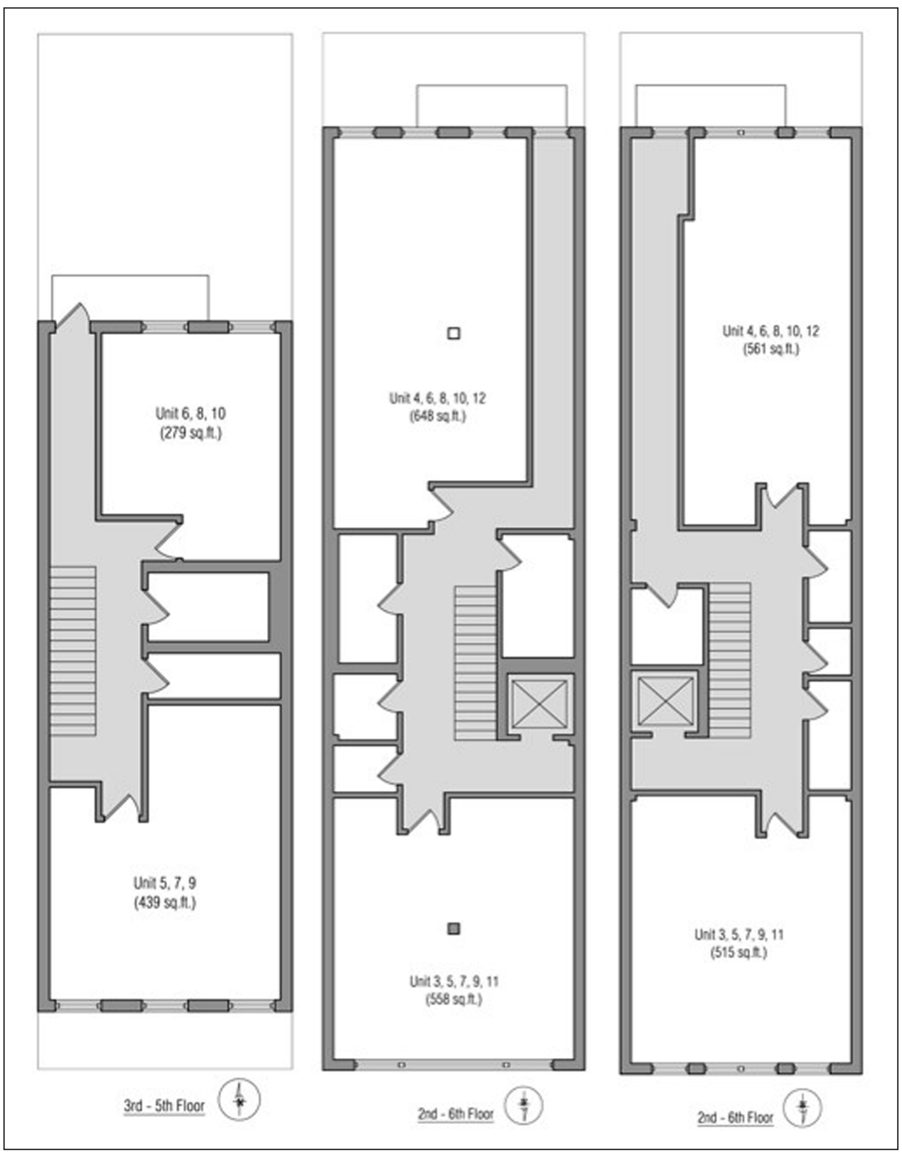

Figure 1: Non-ground-floor plans of buildings 7, 12 and 15 exhibiting an asymmetric core placement.

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In larger buildings, a wider array of core-placement strategies becomes available. The floorplate can be split in two, into quadrants, trifurcated, *etc*. by the core. Regardless of the approach, within all the larger buildings sampled in the higher and lower performing sets, those with asymmetrically loaded cores consistently exhibited a greater heterogeneity of unit sizes upon initial construction; and those with centrically loaded cores consistently exhibited a greater homogeneity of unit sizes upon initial construction. An example of this dichotomy is illustrated in the two plans shown in ***Figure 2***: the first from building 10 (higher performing building, asymmetrically loaded core) and the second from building 17 (lower performing building, centrically loaded core).

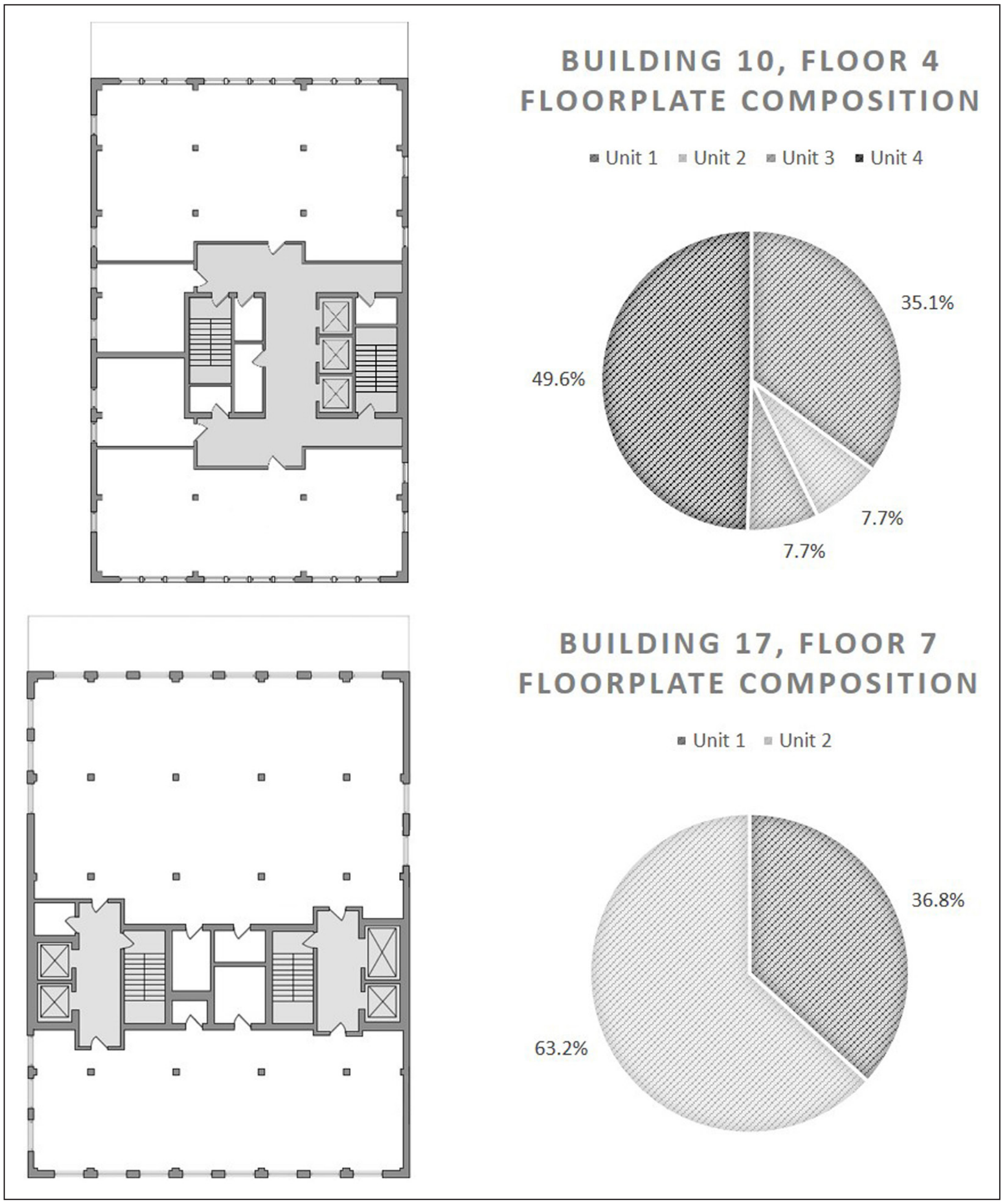

Figure 2: (top) Pie chart showing the percentage of the floorplate occupied by floor 4 units of building 10 upon initial construction in 1921; and plan of said floor. (bottom) Pie chart showing the percentage of the floorplate occupied by floor 7 units of building 17 upon initial construction in 1915; and plan of said floor.

This begins to indicate that the design and placement of the core is not an economically neutral decision, rather one that exerts weight over the initial charging of the floorplate with a diversity, or a monotony, of unit sizes and types (***Figure 3***).

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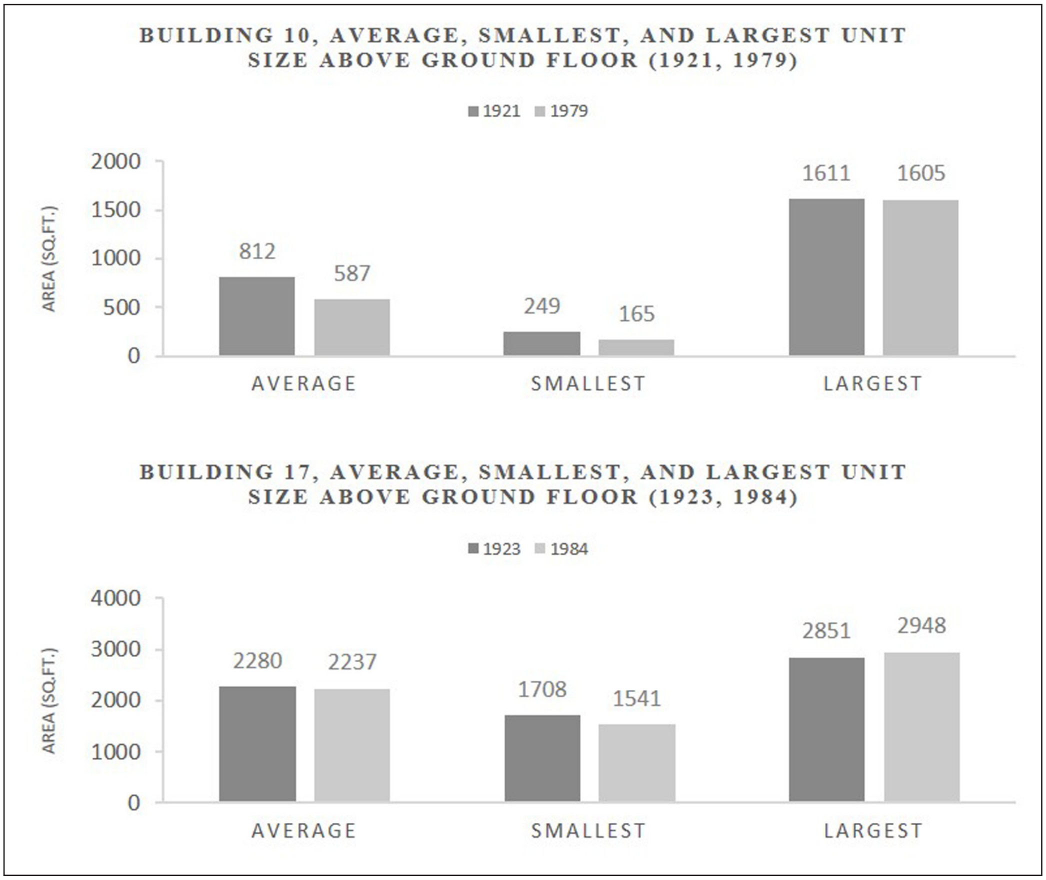

Figure 3: Average, smallest and largest unit sizes for buildings 10 and 17 from their initial construction, and their state in 1979 and 1984, respectively.

Note: Building 10 has a wider range of unit sizes compared with that of building 17.

3.2 UNIFIED COMMUNAL CORRIDOR

Of the buildings examined, 100% of the higher performing buildings contained a unified communal corridor, compared with 36% in the lower performing buildings.

The nature of the communal circulation corridor, which connects each unit to multiple means of egress, serves as a partial reflection of the building developer's, owner's or architect's expectations regarding the grain of occupancy for the building. For instance, in building 16 (lower performing) (***Figure 4***), the communal corridor has been split in two. This indicates that the building has been shaped with the initial expectation of a maximum of two tenants per floor. The floorplate cannot be further subdivided without obstructing each unit's ability to have access to two means of egress, as required by code. This is seen in how the floors themselves evolve over time, as well as how the unit composition of each floor remains stagnant within a span of nearly six decades (***Figure 5***).

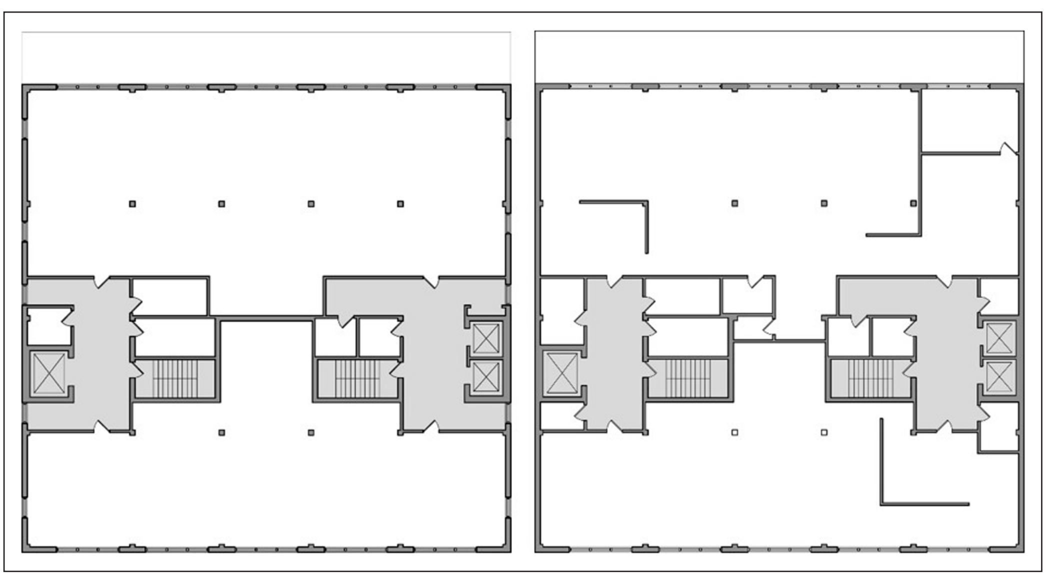

Figure 4: Plan of the fourth floor of building 16 in 1914 (left) and 1973 (right).

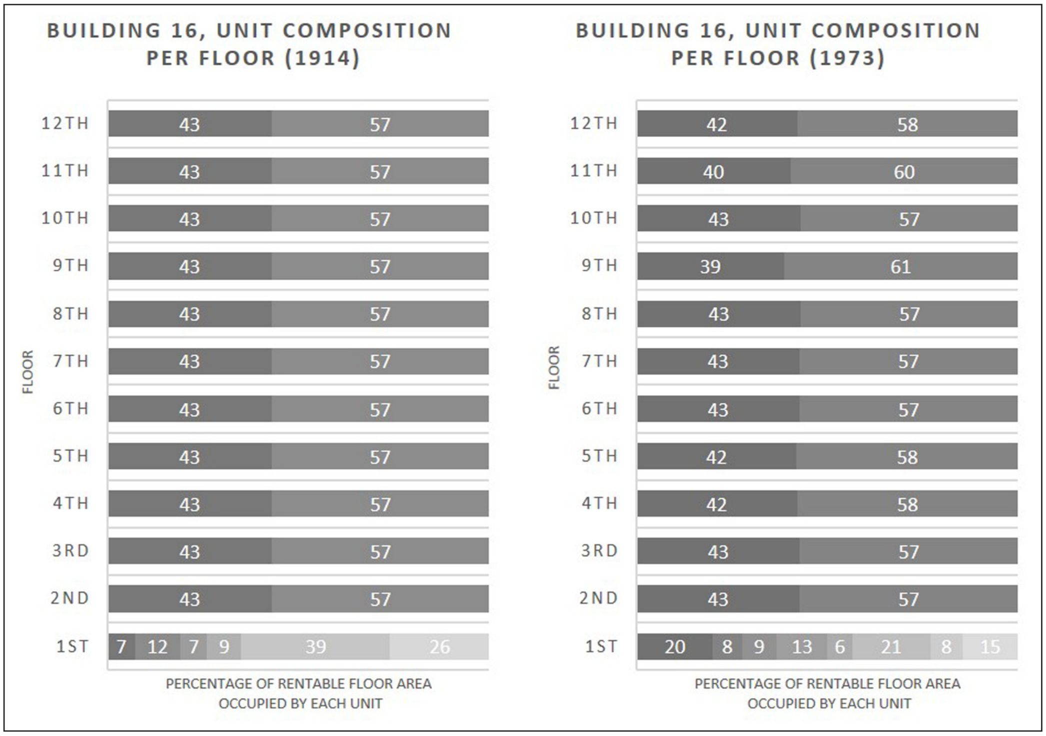

Figure 5: Floor-by-floor unit composition of building 16 in 1914 (left) and 1973 (right).

Building 8 (higher performing), on the other hand, exhibits a unified communal corridor. This allows for unit subdivision to occur without hindering each unit's ability to have access to two means of egress. Compared with building 16, a higher diversity of unit sizes is observed within the evolution of building 8's floorplate, as well as within the floor-by-floor unit compositions of the building as a whole (***Figures 6*** and ***7***).

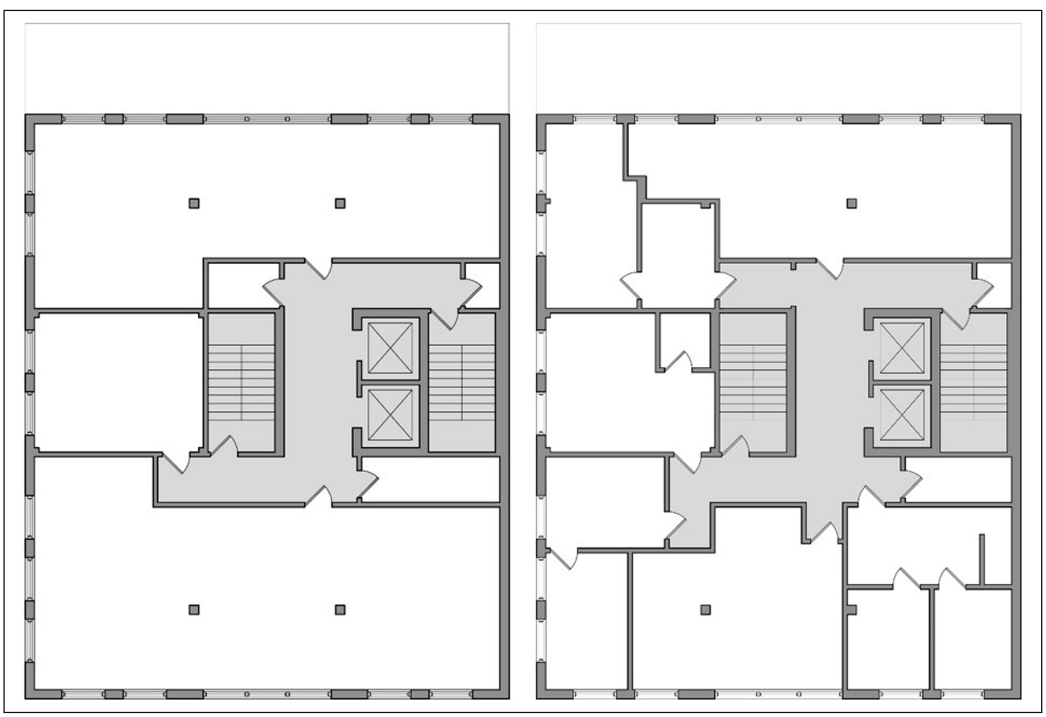

Figure 6: Floor 11 of building 8 (higher performing) in 1926 (left) and 1981 (right).

Unlike the asymmetrically placed core, which supported the *initial charging* of the buildings with a diversity of units, the unified communal corridor supports the malleability with which the floorplate can be altered over the building's lifetime.

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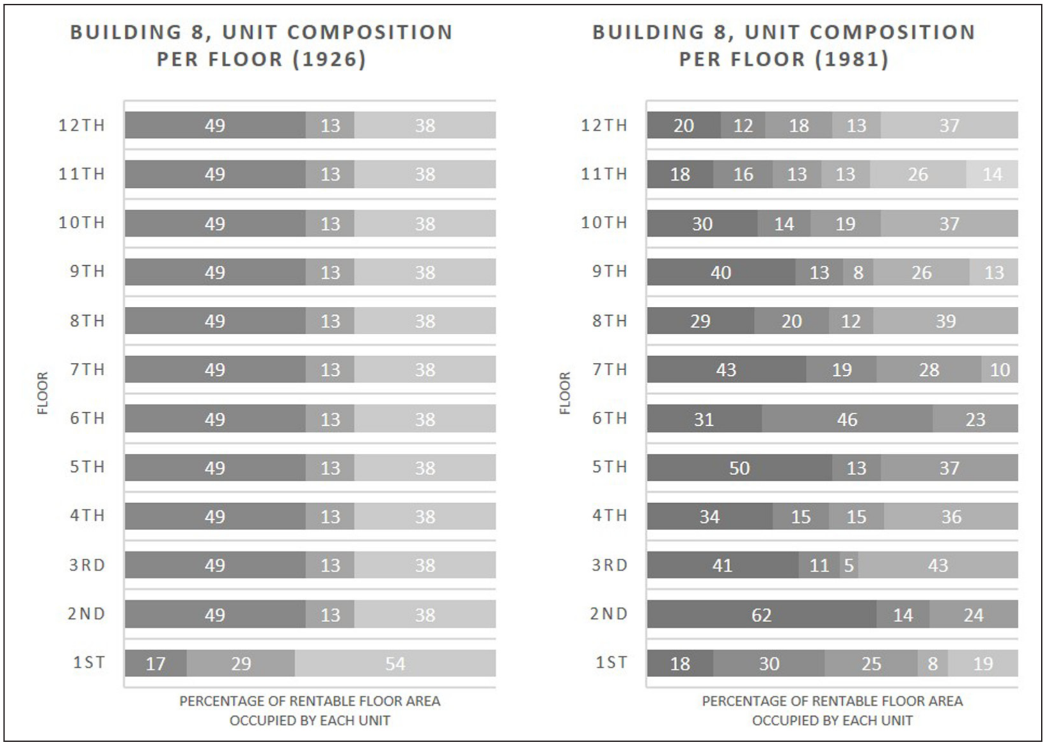

Figure 7: Floor-by-floor unit composition of building 8 in 1926 (left) and 1981 (right).

3.3 BUILDING SIZE

Of the buildings examined, 80% of the higher performing buildings were < 16,000 ft^2 (1486 m^2) in gross floor area, compared with 18% in the lower performing buildings.

Amounting to approximately 450 buildings per year set studied, buildings in the Midtown Garment District ranged from the very small to the very large, from single- to 40-storey structures (***Figure 8***).

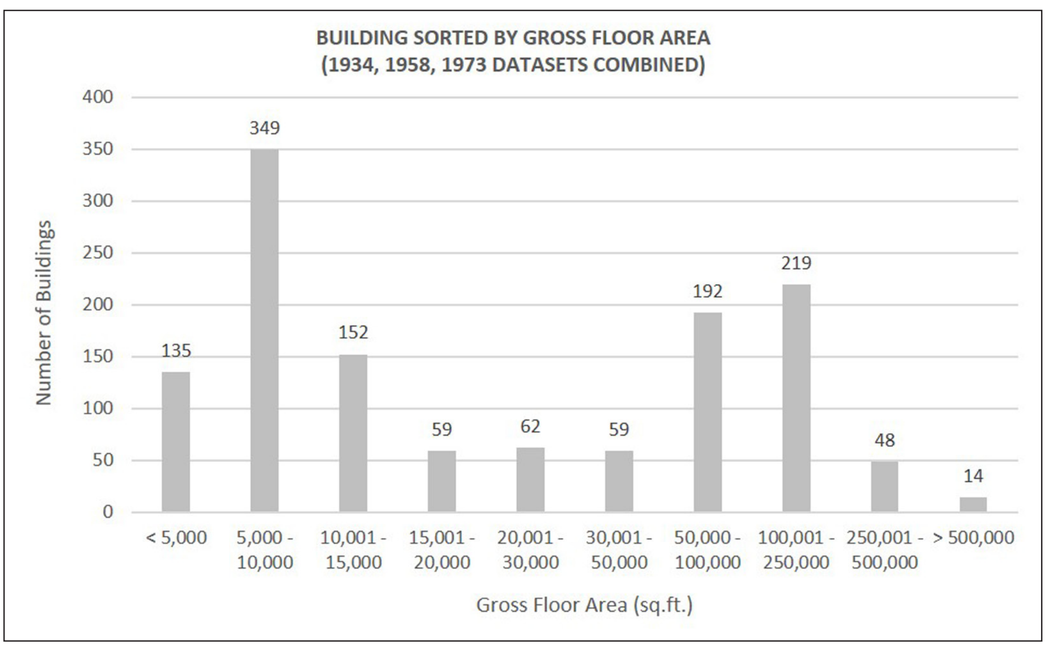

Figure 8: Distribution of buildings by gross floor area for the combined datasets of 1934, 1958 and 1973.

The general relationship between higher performance and smaller size was also observed in the building stock in its entirety. As noted in ***Figure 9***, there was generally a negative correlation between the density of economic diversity supported by buildings and their gross floor area. This applies generally, but there were larger scale buildings that were able to consistently support high densities of diversity.

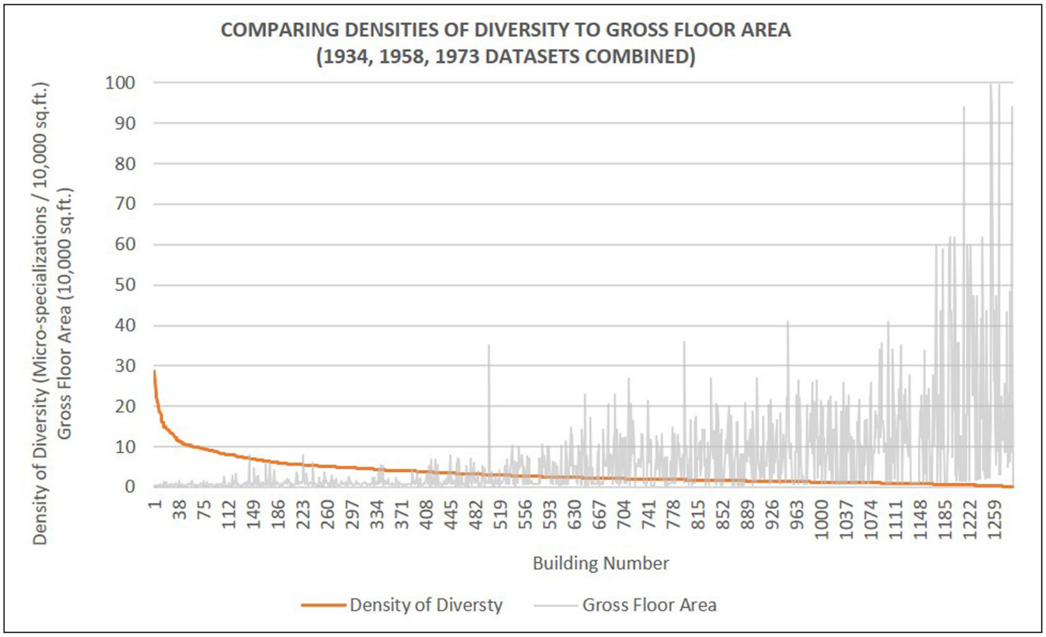

Figure 9: Negative correlation between the density of economic diversity supported and gross floor area. The datasets for 1934, 1958 and 1973 are combined, depicting a total of 1290 buildings.

There are two dynamics at play here. First, smaller buildings tended to innately possess the prior two architectural parameters discussed above. The core was often asymmetrically placed to accommodate narrow lot widths and established real-estate rules of thumb. The communal corridor was unified because there simply was not room to splinter it in two.

The second factor is the connection between unit diversity and property management. Based on anonymised conversations with real estate agents and landlords in the Midtown Garment District during the course of this research, it became apparent that buildings with high diversity of unit sizes tended to contract with more flexible, more agile property managers. Interviewees indicated that while monotonous buildings could afford to have more monotonised and formalised rental or lease structures, more diversified buildings often needed to have much more diversified, and sometimes even partially informalised, rental structures to be competitive. A landlord provided one example of informality: a small-scale garment manufacturer suddenly having to scale up for an anomalous production run and needing to rent a premises (without a formal contract) for two weeks and then vacate.

Since smaller buildings tended to possess parameters that supported the diversification of the floorplate, they tended to have a higher diversity of units. Since they tended to have a higher diversity of units, smaller buildings thus tended to lean towards the more flexible, more agile property manager. The key, however, is that this is not linked to building size, but rather to unit diversity. The particularly interesting wrinkle to this story is that the example of informality given above was from the landlord of building 8: a higher performing, yet larger scale building (with a diversified floorplate).

What this begins to indicate is that larger scale buildings, when they are designed around the parameters often found within smaller scale buildings which support floorplate diversification, are at an increased likelihood of adopting other smaller scale building behaviours (*i.e.* property management structures), which in turn support certain other dynamics of economic diversity and inclusivity.

3.4 INCREMENTAL FACADE RHYTHM

Of the buildings examined, 80% of the higher performing buildings contained facades with regularly alternating increments of solid walls and windows, compared with 45% in the lower performing buildings.

Of the 37 buildings, facades that exhibited more regularised increments of walls and windows (as opposed to those which, for instance, had broad swathes of ribbon windows) were found to have a higher frequency of internal wall rearrangement at the unit and floorplate scale over the building's lifetime.

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Figures 10 and ***11*** illustrate an example of this point, with buildings 9 and 20. The latter has a stretch of windows occupying the middle portion of the facade and exhibits a relatively lower internal partitioning above the ground floor within the building's lifetime. The former, having a much more regularised rhythm of walls and windows, exhibits a relatively higher range of internal partitioning.

Figure 10: (left to right) Elevation of building 20 (1978); third-floor plan (1916); and the same floor (1978). Elevation of building 9 (1974); second-floor (1930); and the same floor (1974).

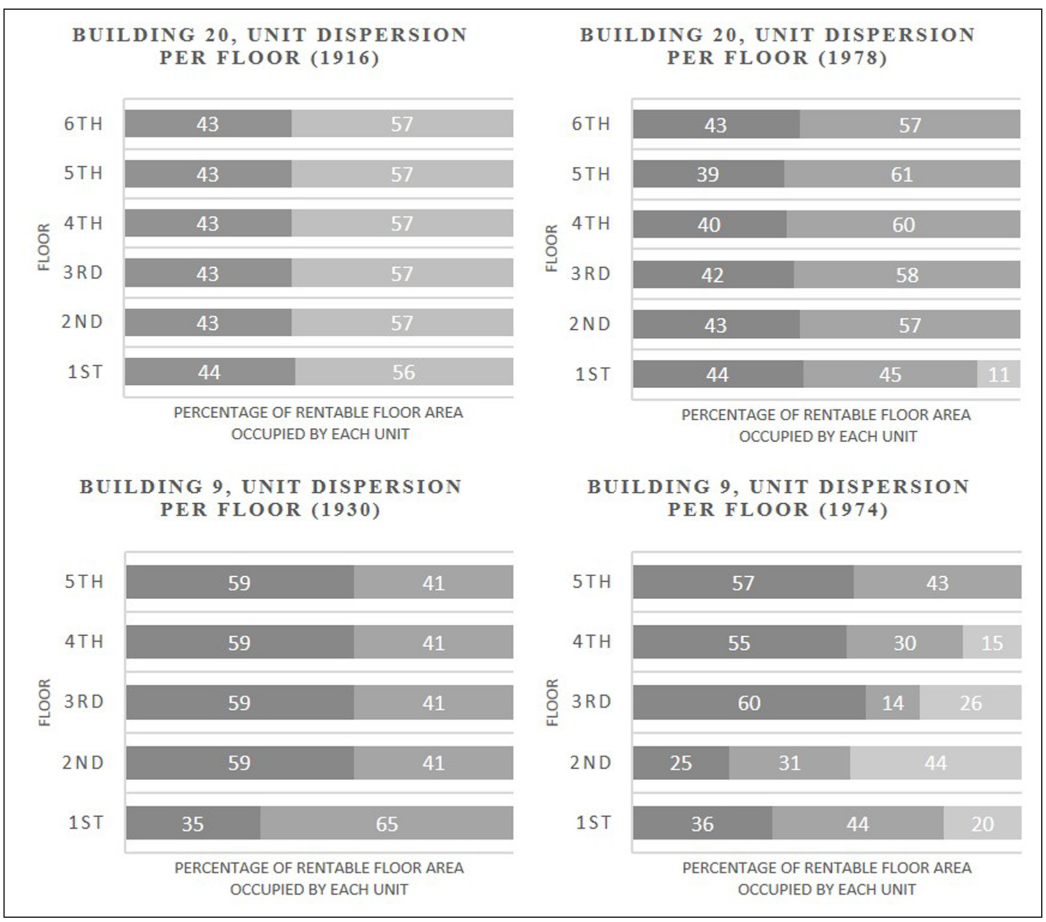

Figure 11: (left to right) Changes to unit diversity in building 20 (1916–78) and building 9 (1930–74) across the buildings' lifetimes.

Note: There is relative stagnancy in building 20, and a relatively increased diversity of units in building 9.

There are two points to focus on here. First, the walled portions of a facade provide space for internal walls to latch onto as they are constructed to rearrange internal space. The regularised presence of such walls on the facade in turn gives the tenant or landlord a wide range of internal partitioning possibilities. Second, the facades studied were composed ubiquitously of brick. Based on conversations with real estate agents and landowners, the critical functionality of brick is that it is a low-tech material. Compared with steel facades, for instance, brick facades allow for internal walls to butt up against them without any high-end customised detailing.

To be clear, a hierarchy of causal weight is present here. Having a regularised incremental facade rhythm does not seem to exert as strong a causal weight as the presence of a unified corridor. The reasoning is rather straightforward. Assume one building with a splintered corridor and another with large swathes of steel ribbon windows on the facade. To overcome a splintered corridor, there would need to be a joint construction effort by the affected tenants and the landlord; furthermore, the type of construction that would have to take place to unify such a corridor would have to be rather robust, requiring a high degree of fire resistance. In comparison, while the lack of regularised increments of wall on the facade make it more difficult to subdivide a floorplate, there were examples uncovered during this research of tenants creating innovative (albeit expensive) methods of joining partitions with, for instance, thick window mullions that were made of steel in order to overcome that hindering condition.

3.5 LIGHT AND AIR AND SOUTHERN EXPOSURE

Of the buildings examined, 67% of the higher performing buildings had more-than-minimum access to light and air via the rear or sides of the building, or both, compared with 54% in the lower performing buildings; and 60% of the higher performing buildings had a south-facing street front, compared with 50% in the lower performing buildings.

Access to light and air was assessed according to the built-world conditions surrounding each building. The conventional Manhattan lot has a depth of around 98 ft (29.8 m). Building codes within the period examined required that buildings be set back 10 ft (3 m) from the rear lot line from the first floor up. This typically created 88 ft (26.8 m)-deep floorplates above the ground floor, with small 20 ft (6.1 m) courtyards emerging in the rear of site, as confirmed by Steadman (2014: 238).

A building's access to light and air was assessed according to the conditions present at the rear and sides of the structure. If the surrounding buildings were shorter than or equal to half the height of the building in question, the structure was deemed to have more-than-minimum access to light and air. If the surrounding urban fabric was ubiquitously above this height, however, the building in question was categorised as having minimum access to light and air.

Unlike the prior attributes, what is taking place with these characteristics is more of a relativistic condition in the context of the broader real estate market. Anonymised real estate agents and landlords who were interviewed confirm that buildings with street fronts with a southern exposure tend to outcompete comparable buildings with north-facing street fronts; and rear units with more than the minimum of access to light and air tend to outcompete comparable units with the minimums simply required by the code, corroborating the aforementioned daylighting and marketability rule of thumb put forth by Willis (1995: 26).

Also, it appears that the causal weight being exerted by these factors is not as strong as the prior characteristics. While a greater percentage of higher performing buildings contained these parameters when compared with the lower performing set, the difference between building sets was not as drastic as in prior characteristics (***Figure 12***).

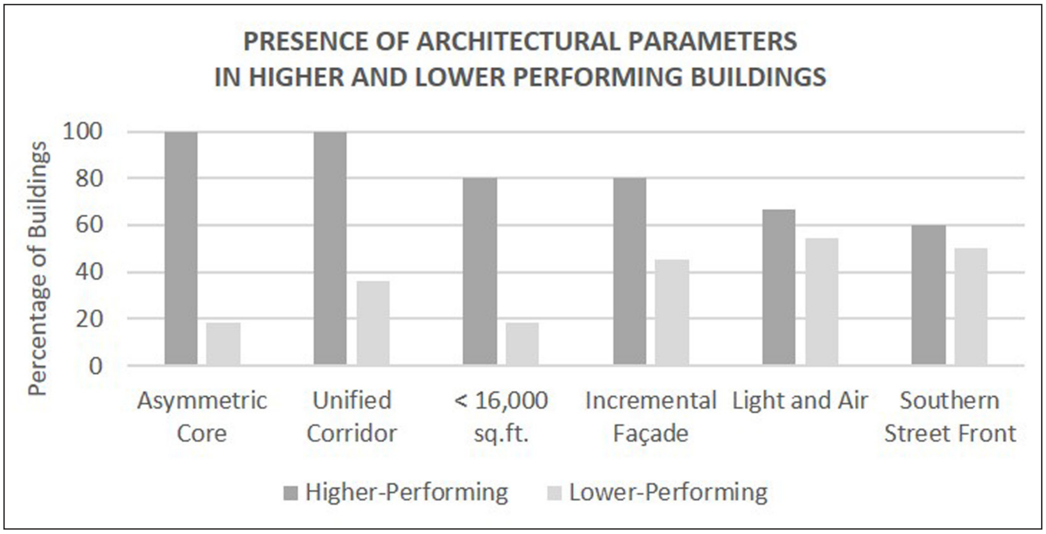

Figure 12: Percentage of higher and lower performing buildings containing the architectural parameters of the study.

3.6 SYNTHESIS OF THE INTERPLAY BETWEEN PARAMETERS

The interconnected relationship within this array of architectural parameters unfolds as follows:

- The asymmetric placement of the core is exerting causal weight that increases the likelihood that the building's floorplates will be charged with a diversity of unit types and sizes at the initial state of construction.
- The unified communal corridor is exerting causal weight that increases the likelihood that the floorplates will be able to be further subdivided or reformulated with a robust degree of flexibility over the lifetime of the building.
- The smaller size of the building increases the likelihood that the above parameters will be present in the structure, both of which increase the likelihood of the presence and maintenance of diversities of unit types and sizes within the building. However, regardless of building size, this diversity of unit types and sizes is the key because it exerts causal weight that increases the likelihood that the building will be managed by a flexible property manager, and that the building will support a range of tenant contract structures.
- The presence of a consistent rhythm of solids and voids within the facade, constructed of a material that is open to being built upon by a range of other materials, exerts a causal weight that increases the likelihood that the units and floorplates can be altered with a robust degree of flexibility over the building's lifetime.
- Above-minimum access to light and air at the back of the site further activates the back-of-site units of the building, making what would otherwise be darker, less ventilated conditions more marketable.
- A southern-facing street front is further activating the street front units of the building, allowing for them to achieve more-marketable spatial conditions.

This array of interwoven parameters exerts causal weight that increases the likelihood that the building will be charged with a rich diversity of economic actors. Having such a multiplicity and diversity of tenants can decrease the likelihood of large parts of a building becoming vacated in a single moment, since such vacancy would require the departure of several tenants at once (Willis 1995: 28). If portions of a floor plan remain continually occupied, there is potentially less opportunity for a floor's smaller spaces to be amassed into larger spaces in order to accommodate, for instance, an expanding firm in search of real estate.

When this relationship between the physical and the economic is understood in full, floor by floor, what may be being exhibited here is a very fine-grained mechanism of physico-economic charging and resistance, supporting the initial inclusion, and long-term maintenance, of a diversity of floor space within a building. A heterogeneity of unit sizes has the capacity to consistently accommodate a diversity of economic tenants over time.

4. CONCLUSIONS AND IMPLICATIONS

> Dynamic and active systems are different from more stable or passive ones. Where active systems interact in characteristics and approaches, passive systems are the elements or structures being processed.
>
> (Lindberg 2018: 23)

The built world, perhaps because of its fixed nature, perhaps because it is the space being occupied, is often incorrectly assumed to be a passive system. The works of Jane Jacobs, Christopher Alexander, Bill Hillier and Julienne Hanson, Stewart Brand, and Howard Davis, among others, however, have attempted to offer a discursive counterweight to this notion by unveiling the intricate and reciprocal relationships at play between the built environment and the social and, at times, economic layers of the city.

This examination of tenancies of loft buildings in the Midtown Garment District of Manhattan shows that the built world is not merely the neutral backdrop for the economic fabric of the city. Rather, certain fine-grained specifics at the building scale influence the potential inclusivity and diversity of the economic fabric of a building. The design decisions of key characteristics, *i.e.* cores, corridors, facades, light and air, have economic impacts that were not previously recognised. They emerge as critical elements of a previously obscured fine-grained reciprocal relationship between the physical and the economic layers of the city.

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