

Autonomous City Form

by
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Master of Architecture
University of Cincinnati, 2012

Submitted to the MIT Department of Architecture
in Partial Fulfillment of the Requirements for the Degree of

Master of Science in Architecture Studies (Urbanism)

at the

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ABSTRACT

Innovations in transportation give us a chance to rethink and redefine the art of city design, centered as much on the quality of public space as on economic efficiency.

Transportation is the backbone of urbanism. What is a city if not a group of buildings distributed in space and thus functioning together. Historically, innovations in transportation challenged the temporal and spatial qualities of the city. The automobile expanded the city in breadth. The elevator built it up in height. However, with the expansion of the city size, density and prosperity, we have sacrificed public domain, and worsened of the quality of the urban form.

This thesis looks into the relationships between transportation technology as a driver and space as a medium of urban design. With the rapid introduction of new technologies in transportation (autonomous vehicles) there is an opportunity to rethink the aesthetics of the urban form and its perception. Through design research, this thesis seeks to synthesize principles of spatial design and propose potential alternatives to the future of urbanism.

Keywords:

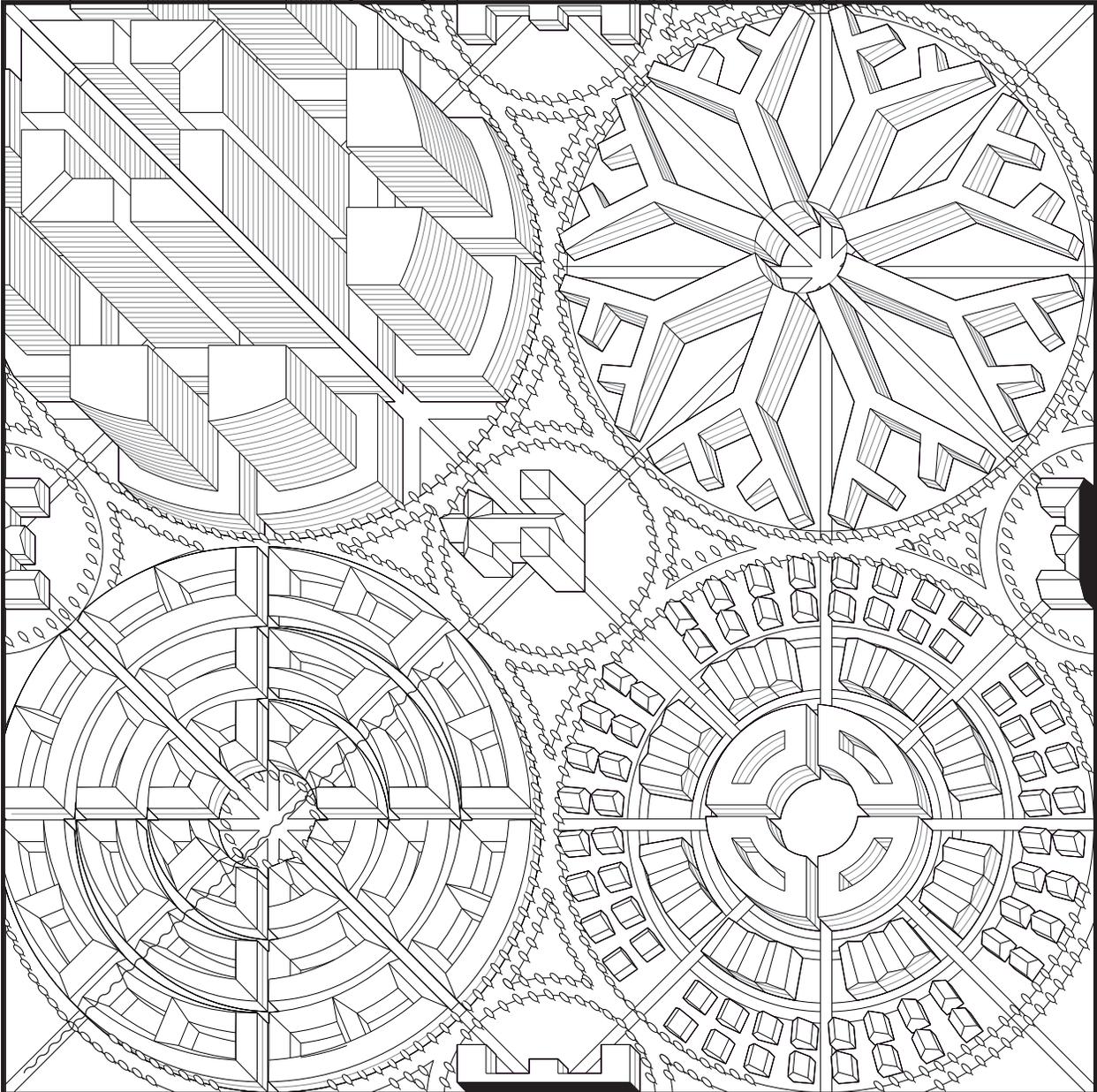
Aesthetic urbanism, Perception of space, Autonomous Transportation

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AUTONOMOUS CITY FORM

AN AESTHETIC MANIFESTO



Pavlo Kryvozub
MIT SMarchS Urbanism

May 2019



Autonomous City Streetscape

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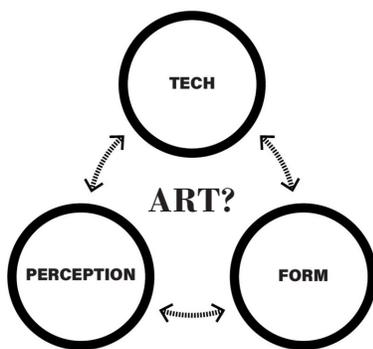


ART OF SPACE



The end product of cooking can be a sophisticated dish, but just tasting the dish does not disclose the steps involved in preparing the dish. Complete understanding of the cooking process requires knowing the ingredients as well as the recipe by which those ingredients were prepared and combined.

Sekuler & Blake, Perception.



< left

Teatro Olimpico

A. Palladio

I am writing this work for myself, filtering every bit of knowledge through the lens of my experience and background, and largely for my personal understanding of the role and function of urban design as a large artistic and aesthetic field.

I plan to use this thesis as a basic framework for a larger work on the nature of architectural and urban space. Thus this work is unapologetically subjective, and I hope understandingly so. After all, art is a subjective sphere of human interpretation of the physical world we live in. Art is not science, yet it apparently and perhaps unnecessarily desperately wants to become one. Art is experiential, emotional and highly subjective. Yet it has certain tendencies that we sometimes declare to be laws. I would like to consider these “laws” as rather lenses through which I attempt to see, order, and analyze the world around me.

Space in Arts

Scale 4

New York. Multiple Authors



Scale 3

City. Michael Heizer



Scale 2

NJ-2. Richard Serra

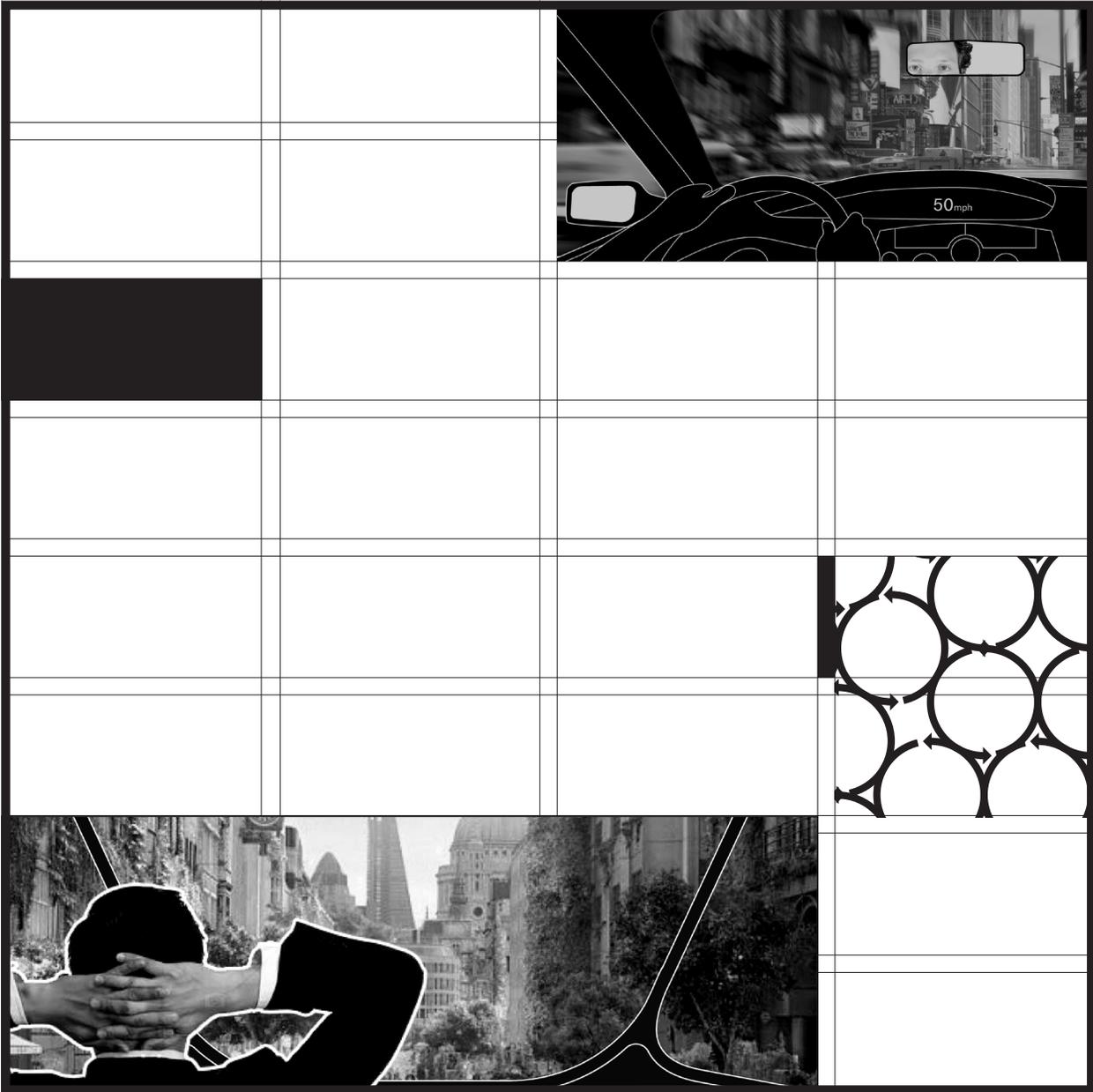


Scale 1

Space in Between. Marina Abramovich



Problem



Robin Evans in his seminal Projective Cast suggested that **architects do not produce geometry but consume it**. But where does this geometry come from? Is it a product of our perception? What if our perception of urban space changes due to technology what geometry will we produce?

What makes an urban space good? Everybody experienced an urban space that feels aesthetically pleasing from the very moment you enter such space. Some of these spaces have uplifting spirit such as St. Peter's square in Rome, some squares such as Plaza Major in Madrid is a pure artistic experience as sculpted from urban space, some are too big some are small. Yet everyone is different in the sensation it creates via our perception.

Architects largely through training and practice get an inner sense, or an illusion, of how to produce an artistic space as product of their vision and imagination. Yet **somehow, we have not developed a more substantial explanation, an algorithm on how to create a space that will have a needed prerequisite emotional expression**.

Is this a matter of talent and experience? If it is the case than urban architecture is a form of art or craft but not a science.

Largely because of this often architects pay little attention to the quality of spaces they create. Driven by multiple competing factors such as economy, client's politics, practical considerations (fire truck turning radius)

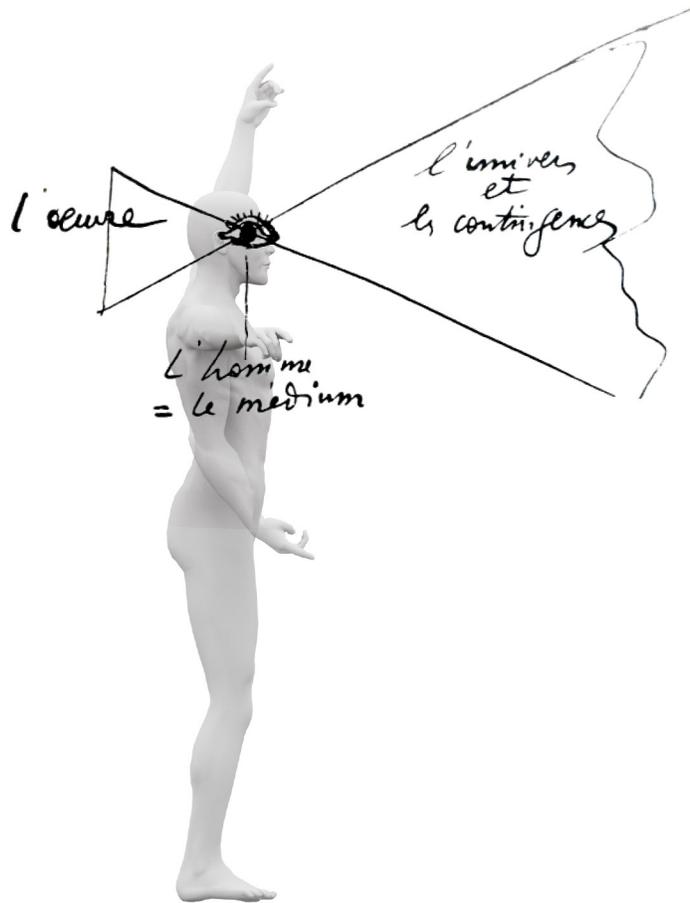
we lose on the quality of space we create. Looking at the two-dimensional drawing that represents an urban space on paper or even on the scaleless computer screen we are not getting fully the quality of the future space we intend to create. Before computer the best tool we had for presenting space on two-dimensional medium was the perspective method. Even with computers we do not go beyond a two-dimensional representation of three-dimensional design. Today we have Virtual Reality that even with its current technological limitations (poor image resolution, smaller field of view) it is the best method for understanding space we have ever had. If perspective as a method of spatial abstraction was able to produce the best examples of urban spaces we know today, I wonder we can achieve having a full immersion into the three-dimensional space, however virtual it is?

Yet, are we even sure what to create in the virtual world? Even with VR we do not understand space because we don't know the perceptual mechanisms at play. The negative space of urban forms is one of the hardest tasks for our brain. It involves all of the Aristotle's five senses as well as the sense of balance (equilibrioception) and kinesthetic sense (proprioception). Our brain is so overwhelmed with such work that it skips our consciousness delegating spatial perception to our instinctual primal brain. Is this why it is so much harder to understand space as a product of design and art?

Basis



NATURE



HABITAT

Man is a product of nature. He has been created according to the laws of nature. If he is sufficiently aware of those laws, if he obeys them and harmonizes his life with the perpetual flux of nature, then he will obtain (for himself) a conscious sensation of harmony that will be beneficial to him.

*All man has to go on are the laws of nature. **He must first understand the spirit of them, then apply them to his environment in order to create out of the cosmos something human.** In other words, a genuine new creation for his own use.*

Nature is wholly mathematical in substance, but our eyes perceive it as a series of chaotic spectacles (for the most part).

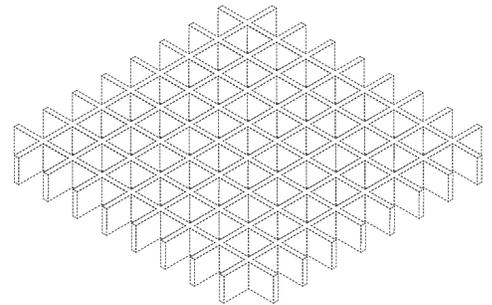
*And for this reason, in order to save himself from this chaos, in order to provide himself with a bearable, an acceptable framework for this existence, one productive of human well-being and control, man has projected the laws of nature into a system that is a manifestation of human spirit itself: **GEOMETRY.***

In this artificial universe he is able to live at ease, whereas he is doomed to suffering to rude shocks as soon as he leaves it.

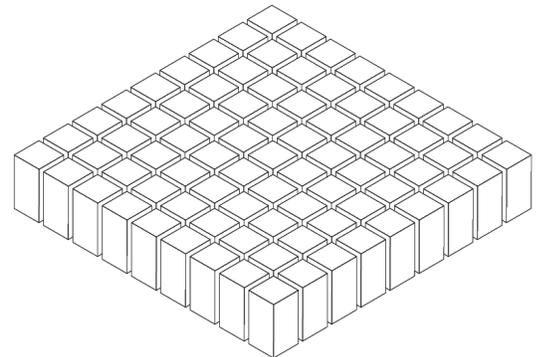
Le Corbusier. The Radiant City

Purpose

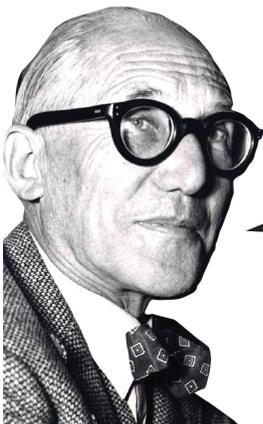
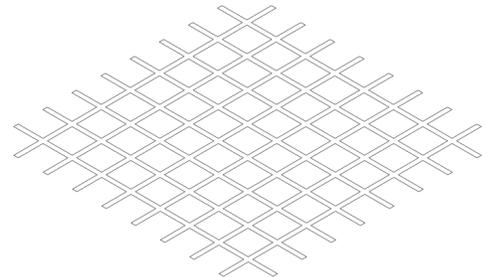
Urban Design



Architecture



Planning



City planning is a three-dimensional science, and each dimension is linked to the others. It is not a two-dimensional science, as the town councilmen practice it and as the schools teach it.

Nothing that concerns the surface can exist otherwise than in terms of height. Here is the key to all solutions.

The purpose of this work is to seek out art in urban design. Even the term itself produces questionable connotations.

What is designed exactly and how?

Urban design exists somewhere in the grey zone between planning and architecture. And, as a result, is subservient to both--placed in the purgatory between red lines and opportunistic development. As a result, it no longer focuses on producing an aesthetic product but rather reacts to the complexities of our overly complex and diverse society.

One might argue that we don't need an aesthetic urban space. At least in social agendas it is definitely not in the top list of priorities. Yet, I believe that the success of the society as a whole is not only measured in terms of GDP per capita but also in terms of how a society views its environment and

how it reflects its advancements on it, creating and ordering the living space around it.

Therefore, in my opinion, **the agency of urban design is to create an interface between the complexities of public and private interests.** And, the medium of urban design is space itself (space between buildings according to Jahn Gehl)--not the objectification of buildings, the rationalization of zoning or beautification by landscaping.

Using contemporary analogy, **the role of urban designer is to create a successful user interface between personal and the collective experiences of physical environments.** In this work I attempt to achieve three things: define the basic principles of spatial design, look at how changes in transportation may return beauty to the urban life and apply the this knowledge to generate a speculative proposal for an Autonomous city within Detroit.



Vision



To see or hear is nothing.

*To recognize (or not
recognize) is everything.*

Andre Breton.

In the next chapter I attempt to summarize **the basic principles of space as the medium of urban design**. Taking bits and pieces from Kevin Lynch, Christopher Alexander, Jahn Gehl, Le Corbusier, E.H. Gombrich, Rob Krier as well as others

I attempt to stitch together an abstraction of the spatial medium starting from a human body as a core projector and receptor of space through the limited apparatus of human vision and human motion.

Taking into the consideration the notion expressed by Le Corbusier, we are what we see, is as true as we are what we eat. The urban space is the food for urban existence. As food, space can be healthy or not; pleasant or indigestible. Unfortunately, today we have lost the appreciation for good space as a lot of us lost appreciation for the wholesome food.

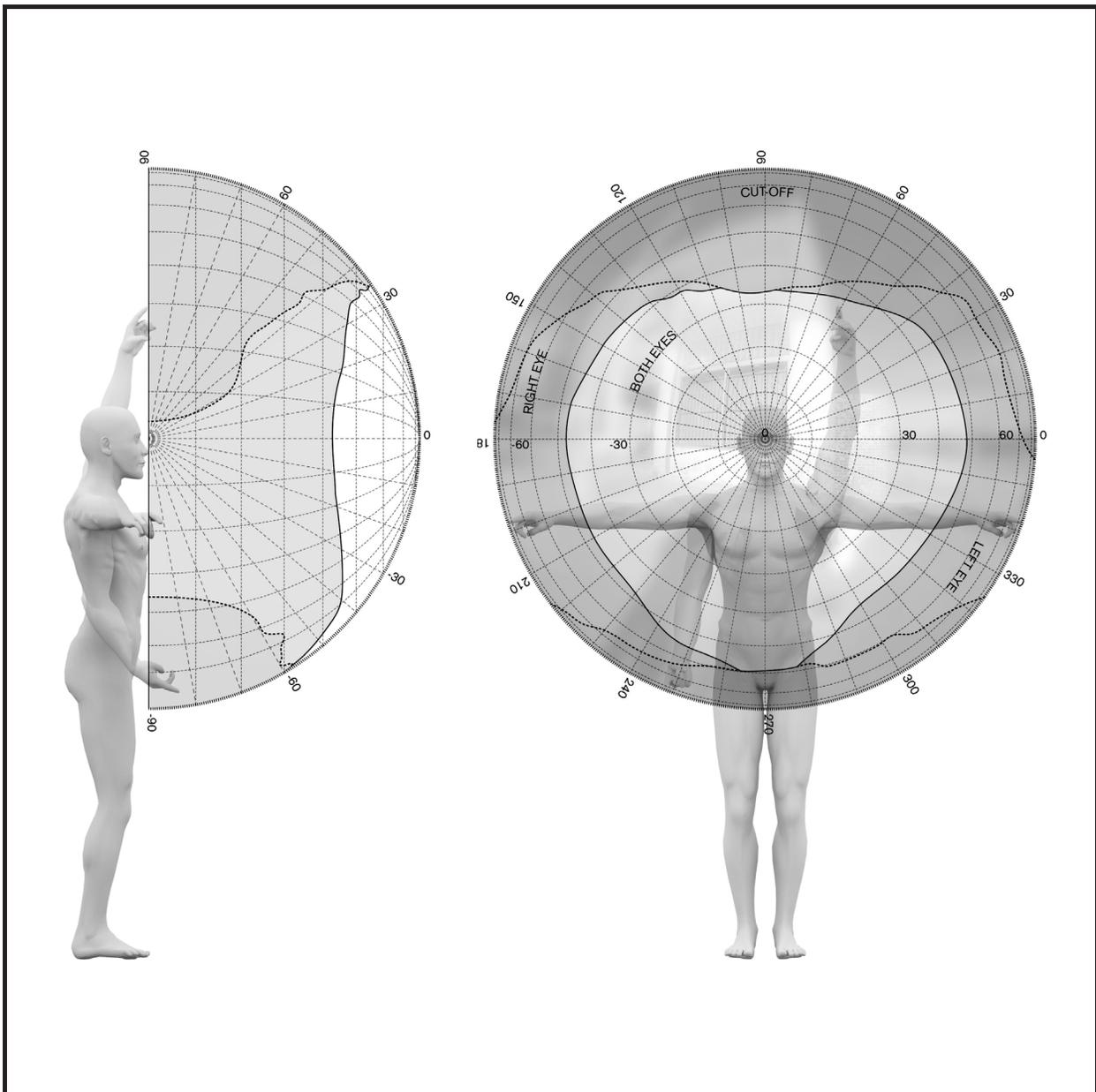
I don't want to sound retrogressive but we should look back into the former cities designed and created for human body experience and consumption as a paragon of the future urbanism.

We are predestined to be able to admit only a certain amount of visual information into the visual cortex, and even less will be actually processed through fovea centralis, and down by our consciousness. Brain provides us with the most efficient and economic level of awareness sufficient for basic survival. We do not need to hunt or evade predators, yet we have a brain of our primeval ancestor aimed on survival, awareness, and the ability to seek regularity in the irregular world. As E.H. Gombrich points out, our response to meaning is not accompanied by full awareness. Thus, it is hard to argue for the importance of slow static human scale space in New York's downtown where the only spatial cues we receive is how not to be run over by a flow of cars or humans.

Our sensitivity to space is the instinctive projection of our consciousness on the world outside. Our brain is tuned to be sensitive to certain visual and spatial conditions in our perception. Long narrow streets initiate a single vector motion within it, slow, curved and narrow streets create a much slower path that runs into a well proportioned and enclosed squares that create an inviting slow space that together with social life create a sense of place.

As Richard Gregory in his “Eye and Brain” suggests: “We think of perception as an active process of using information to suggest and test hypotheses.” Gorbrieh goes as far as to attribute these built-in hypothesis to the sense of order, a build-in mechanism for sensing and creating order. This is evident in our biases for simple orders and the tendency to

discern regularities in our disordered world. Therefore it is a role of designer to create a sense of order for the urban experience. Order has to exist in order to create. We became creators as soon as we were able to supercede our own order within the framework of the higher order of “nature”.



PAST

NOW

FUTURE

TECH

PERCEPTION

FORM

transport

speed

conceptualization

media

architecture

urban form

Essential

Primordial

Egypt

Greece

Middle Ages

Renaissance

Industrial Revolution

Information Era

AV

PC & Internet

VR

Walking

Horse

Wheel

Carriage

Bicycle

Elevator

Metro

Car

Plane

AV

PC & Internet

VR

160,000 BC

6000 BC

3,500 BC

~1500

1817

1853

1863

1885

1903

2009

5 km/h

40 km/h

~ km/h

40 km/h

20 km/h

45 km/h

<200 km/h

instant

Unspatial representation

Obliques

Planar space

Attempts of spatial representation

Perspective

Gestalt

Photography

Cinematography

CAD

VR

Unspatial representation

Obliques

Planar space

Attempts of spatial representation

Perspective

Gestalt

Photography

Cinematography

CAD

VR

Unspatial representation

Organic

Grid

Entropy of Grid

Idealized form

First regularized Urban Form

Carhu & CIAM

Cerda

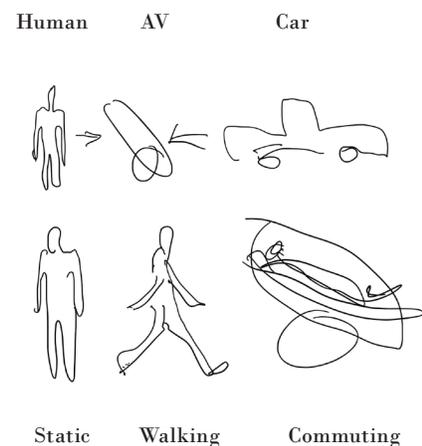
Evolution of Perception

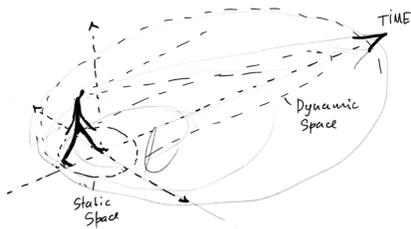
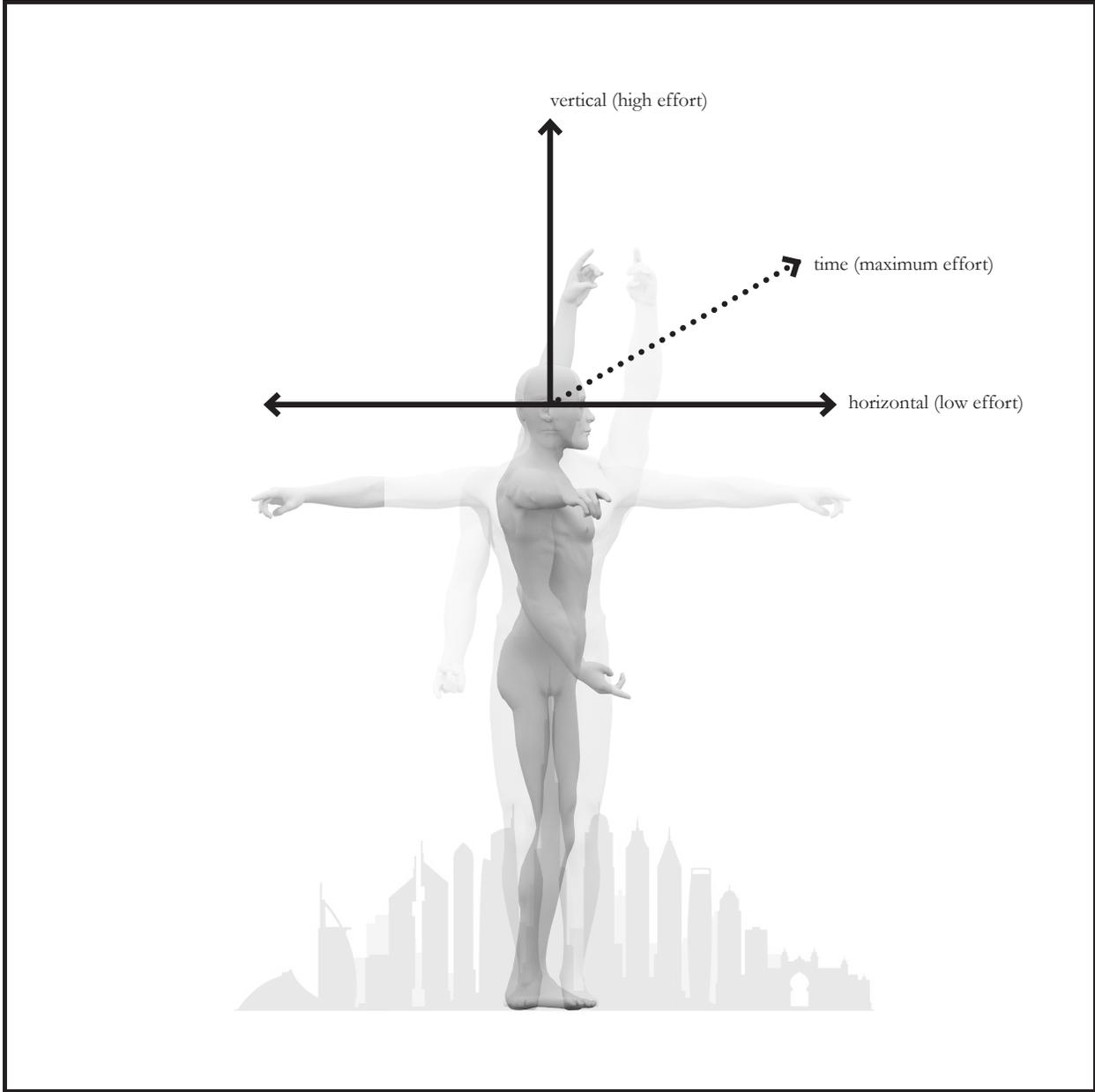


This table juxtaposes the development of the technologies of movement such as, the invention of the wheel, with the technologies of perception throughout human history, such as perspective, or recently Virtual Reality, and looks how such this techno-perceptual evolution were reflected in the the development of the urban form. With the increased speed of human motion and the growth in power of spatial conceptualization and representation our artificial environments were directly affected

I would like to state that looking back in history we can predict that Autonomous Vehicles coupled with the advancements in space representation (VR, BIM, Data Visualization) are going to directly affect the city form and its perception. **It is the first time in human history that the human eye | body apparatus can be removed from the mechanism of movement through space.** Therefore, our perception will return to its original state of observation instead of reaction and navigation.

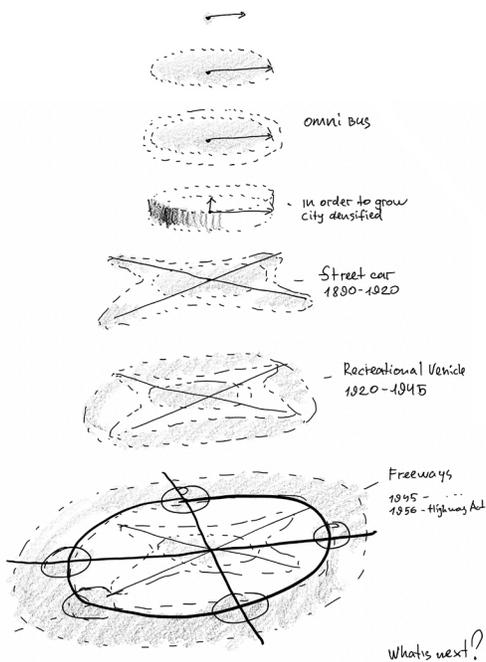
The age of horse and carriage that continued with the iron horse of car is soon to be over. Therefore, I believe, we should revisit the basis of urban form and space that were laid out for human navigation reforming the future city for its observation and spatial health of its public space.





Components of space in four dimensional space

Measure of Space



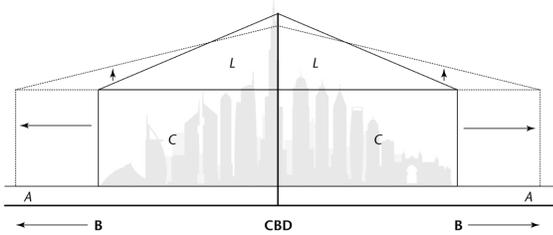
Development of the collective body in the four dimensions of space-time.

Every significant transformation is associated with the technological breakthrough that reduces the dimension of time thus effort and increasing the status quo between the effort and benefit of the urban function.

City is the reflection of our collective bodies on the physical reality we form for our collective use. It follows the same logic and economy as our physical body that is bound by the same laws of nature. Thus, the city grows horizontally due to the laws of maximized benefit for the consumed effort, due to the physical nature of our bodies to expand territorially rather than densify vertically counteracting the gravity.

Our bodies as well as our cities exist in four dimensions. Where dimension of time corresponds to the degree of effort and resultant benefit. The body of urbanism starts from a single point, intersection of paths, or a market square that attracts people following our social nature and expands the four dimensional collective space formed by our collective body. This space is comprised of **three static** (Cartesian) dimensions (that we perceive visually) and the dimension of **time**, that in the Cartesian reality is measured by distance and measured through the rhythm of our bodies (foot steps, heartbeat) and experienced through motion of our perceptual selves.

Economy of Space-Time



Monocentric model

Commercial Real Estate Analysis and Investments.

David Geltner

Economic cross-section showing three tiers of the building cost

A - value of agricultural land,

C – cost of construction,

L – location rent.

According to the central place theory, concentration of economic and social resources is inherently a function of distance; be it a distance from one human to another or a distance from a place of production to a place consumption. One might argue that urbanization began with the discovery of the wheel that brought down the physical labor attributed to the factor of distance. Since then transportation played a key role

in the optimization of the use of time and effort. The collective living as such stems from the need to maximize production and minimize effort (laziness is natural according to Kahneman¹). The basic requirement to get from point A to point B in the shortest amount of time is the driver of progress that pushes us forward in the continuous attribution of the natural environment.

What differentiates the basic society from the modern one is the ability to transport population faster, further and cheaper.

Therefore, economy is the main factor in the life of every city (arguably, the sole reason for city's existence). The classic Monocentric economic city model is useful in predicting how autonomous transportation might affect urban form. It abstracts city to its basic components such as the size (radius) and the rent price (\$) and is driven by the value of time which is a factor of transportation.

$$\mathbf{VOT = MU_{tt} / MU_c}$$

Value of time as a function of time and cost of transportation.

Location, Location, Location...

According to Monocentric model, value of time is the biggest factor that determines the economy of the city. The closer you are to the center location, the less time you spend on transportation of goods and services and thus the value of such location (location rent) increases.

1 Kahneman, Thinking, Fast and Slow.

As we can see from the drawing on the left the reduction in the cost of transportation decreases location rent, and expands the footprint of the city following the economic principle that states:

Declining transport costs (per person, per mile, or per year) holding population and income constant, will always reduce the value of location rent in the center of the city; the effect on the location rent near the periphery is generally ambiguous, depending on changes in density. (Geltner, 2006)

Space and distance interconnect on multiple levels. The Latin for distance “spatium” unites both definitions into one morphological root, semantically suggesting the inherent connection between them. The speed as the function of time and space evolved along with humanity. From the world of strenuous need to cover many miles to procure our basic energy needs, where the balance of energy spent and energy gained often equaled to less than zero, we transformed into the state where the same primordial distance covered in the infinitely short amount of time freeing our energy and time for more creative and productive pursuits.

Konstantinos Doxiadis in his treatise Ekistics states that minimization of effort is essential in the enhancement of actual and potential contacts within a community. The car has significantly increased the speed of such connectivity; however, it has violated the

principle of removing psychological discomfort from such connections. The road infrastructure has created a sense of detachment by the introduction of high-speed highways into the cities. The introduction of cars significantly reduced the cost of living in cities but created an infinite loop of reduction of travel costs that instigates the city growth and densification as it democratizes the urban living.

Advancement in technologies of autonomous transportation will significantly change the urban landscape. Currently it is impossible to know if AV will promote further urban sprawl², or if on the contrary it will help to increase urban density. In any of those cases, we should reevaluate what is the most optimal urban structure for this new form of transportation. This means questioning the gridiron street network in which much of urban development relies.

2 Berger, Kotkin, & Balderas-Guzmán, Infinite suburbia.



DEFINE



*Form is emptiness, emptiness is form
Emptiness is not separate from form,
form is not separate from emptiness
Whatever is form is emptiness,
whatever is emptiness is form*

The Heart Sutra

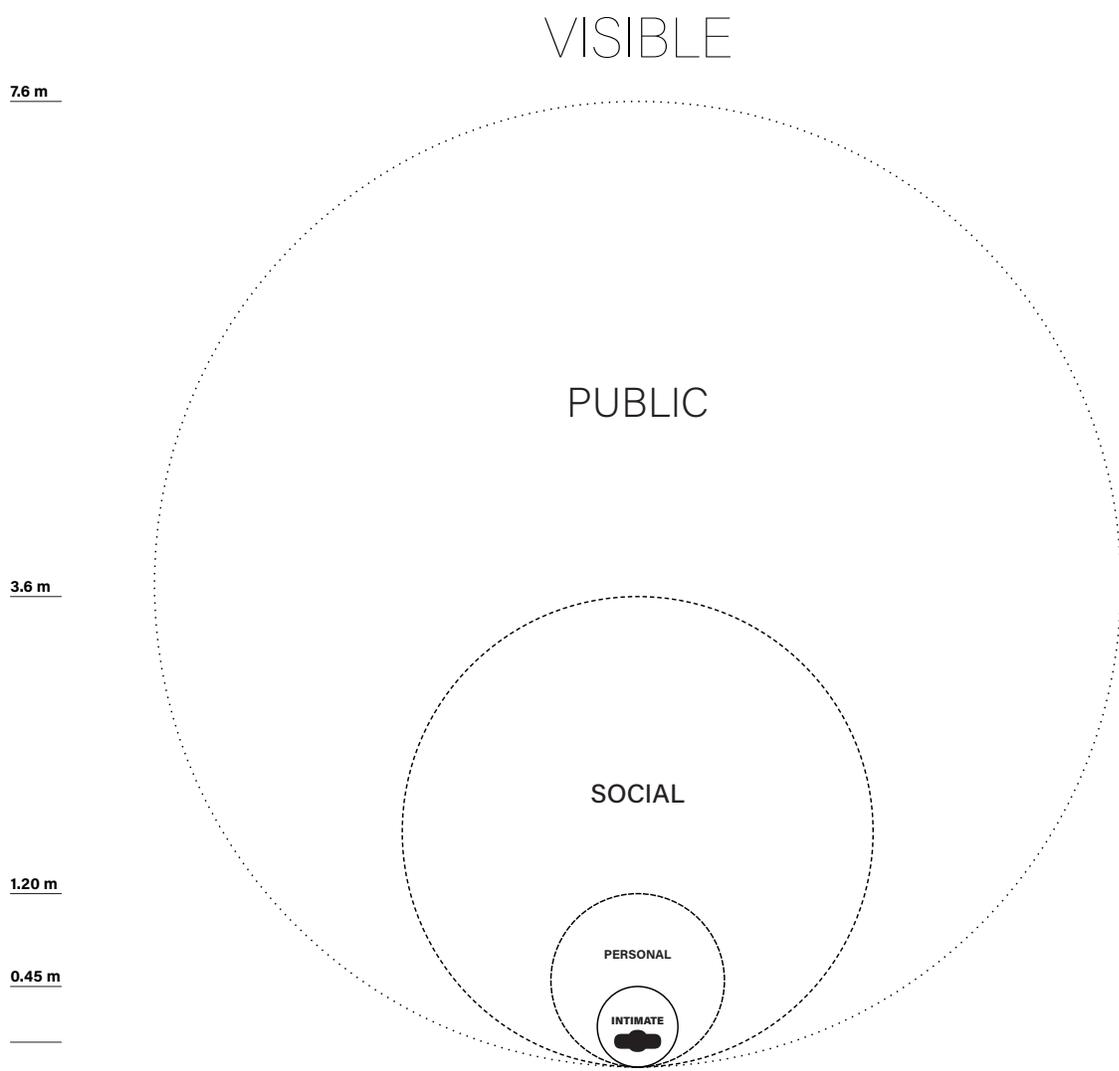
**In the next three spreads
I summarize the definition
of personal space, how it
reflects on the creation and
function of urban space,
and argue that the mode
of transportation directly
affects the urban form.**

< left

Double Negative.

Michael Heizer

The drawing depicts my vector based interpretation of the zones of Proxemics developed by Edward Hall in The Hidden Dimension.



¹ Static Space



Urban Space is in the eye of beholder.

The departure point of urban space definition is the physical as well as social body of an observer.

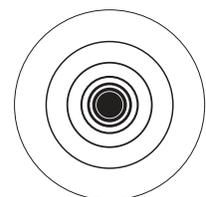
In his book *The Hidden Dimension*, Hall studies the physical definition of personal space, its cultural and social factors, and comes up with the theory of distance that determines the spatial relationship between human beings. (outlined on the page)

I would like to extend his notion of social space on the physical world as a reflection of the social world. In his work he already suggests the broad cultural differentiation between nations claiming American as a “non-contact” culture in its essence. Urban space as a reflection of our cultural selves provides a clear support of such notion. A “non-contact” nation would produce a “non-contact” urbanism as a

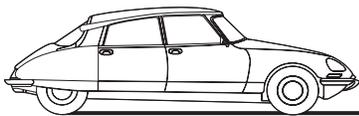
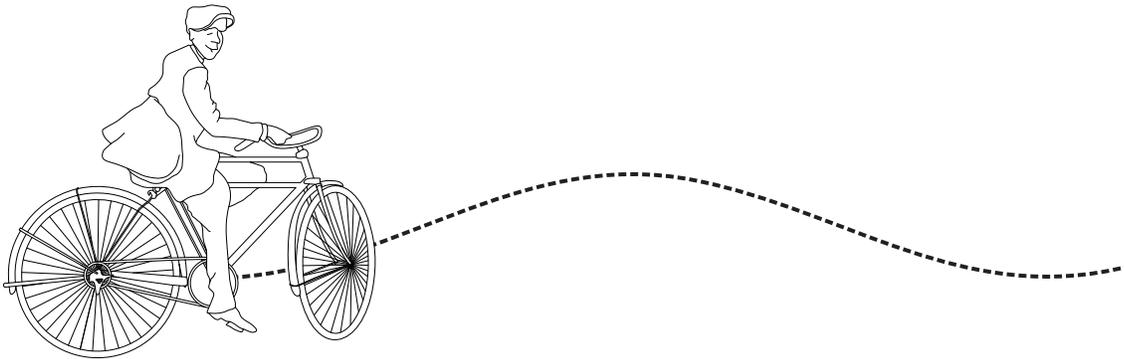
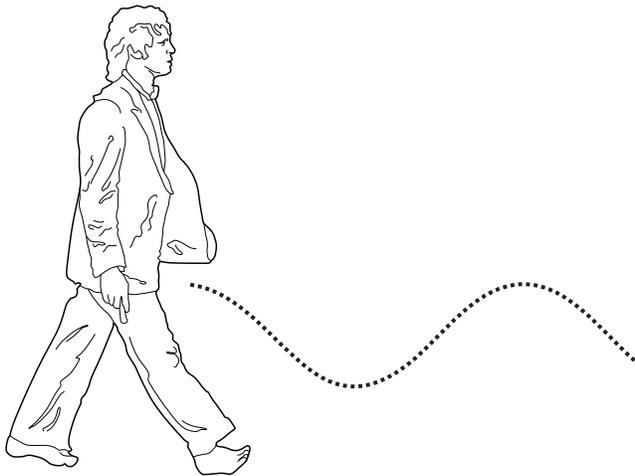
collective body for our collective selves. This “non-contact-ness” is easily observed in American city designed for “non-contact” transportation and Suburbanization as deurbanising factors that minimize the personal contact between individuals .

Going further I would like to reflect on the same relationship between personal space and the build environment in terms of visual proximity to the street wall, its social definition, relationship between static and dynamic space and spatial

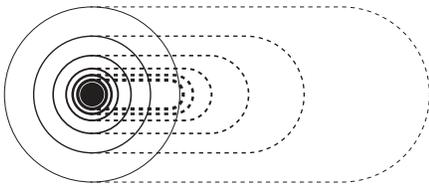
STATIC SPACE



*Every mode of motion
in space has a physical
reflection in the design
of urban space.*



² Kinetic Space



DYNAMIC SPACE

Urban Space = Space * Distance
Urban Perception = Speed * Distance

The biology of human perception proves that the speed with which we experience urban space and mode of such experience can directly influence the design of urban space. Perception of space of a pedestrian and driver are different not only on a perceptual, but fundamentally biological level. According to Sekuler and Blake motion is an integral part of our perception of space.

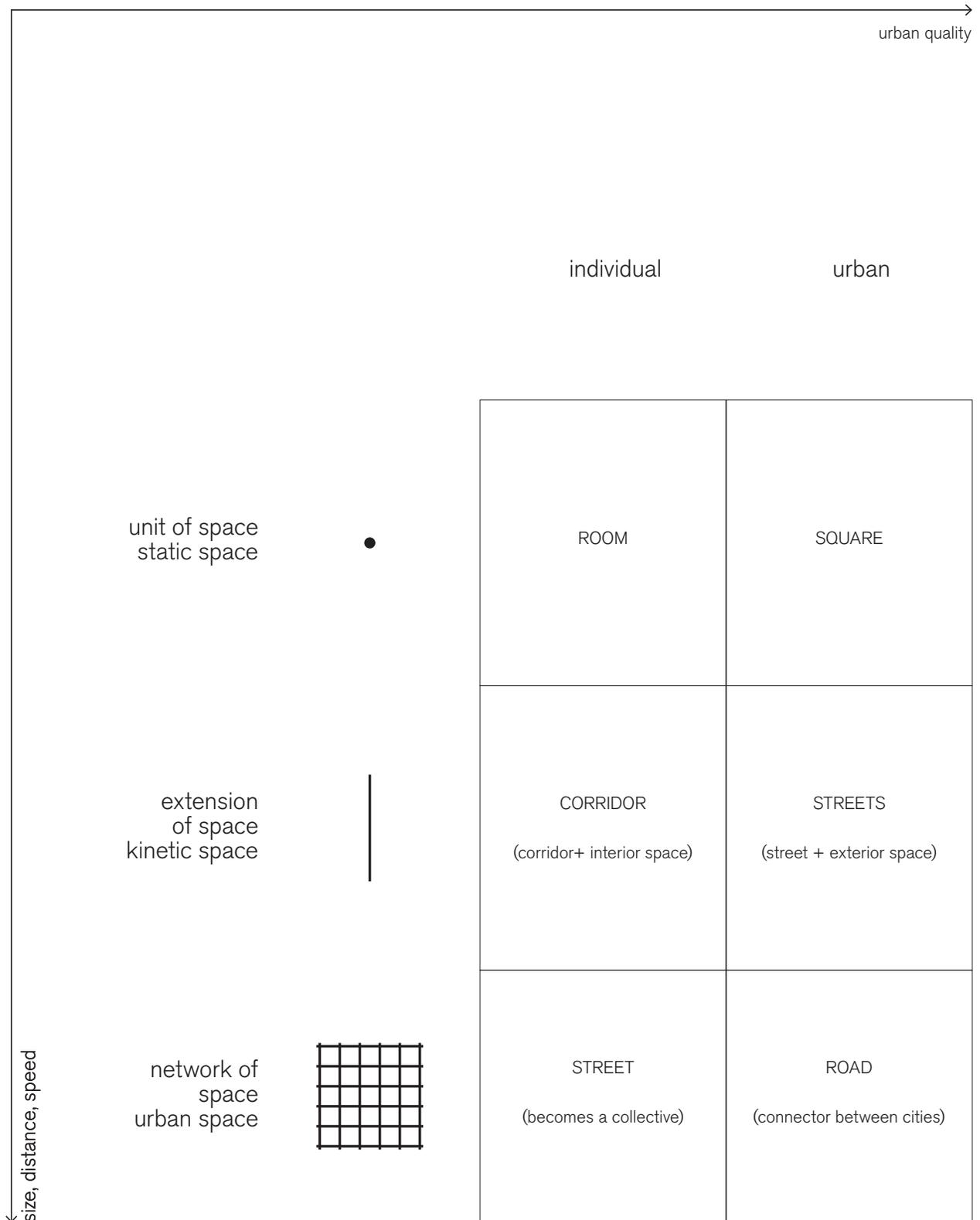
“Unlike a photograph, the retinal image is continuously changing, because of our own movements and because of the movements of objects in the environment.”
Sekuler & Blake, Perception.

This spatial sensing mechanism has a direct link to the physical space defined by James Cutting (1997).

There are three spatial sources of depth information: Personal Space (1,5 meters – arm’s reach) Action Space (30-meter space of immediate action) Vista Space (unreachable but essential for navigation).

These sources of depth are defined for a person on foot, a person in a car has an action space that is far beyond 30 meters.

The drawing in build on the ideas expressed by Christopher Alexander in A Pattern Language

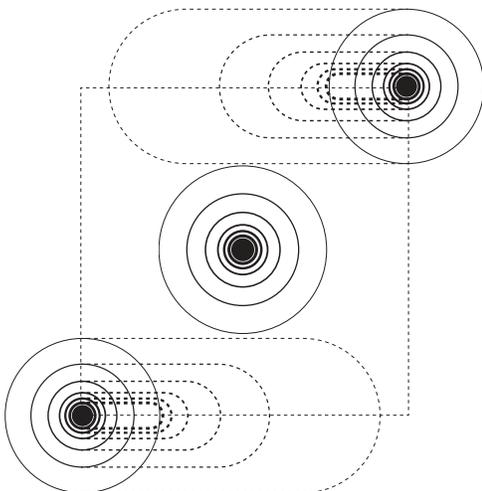


³ Nomenclature

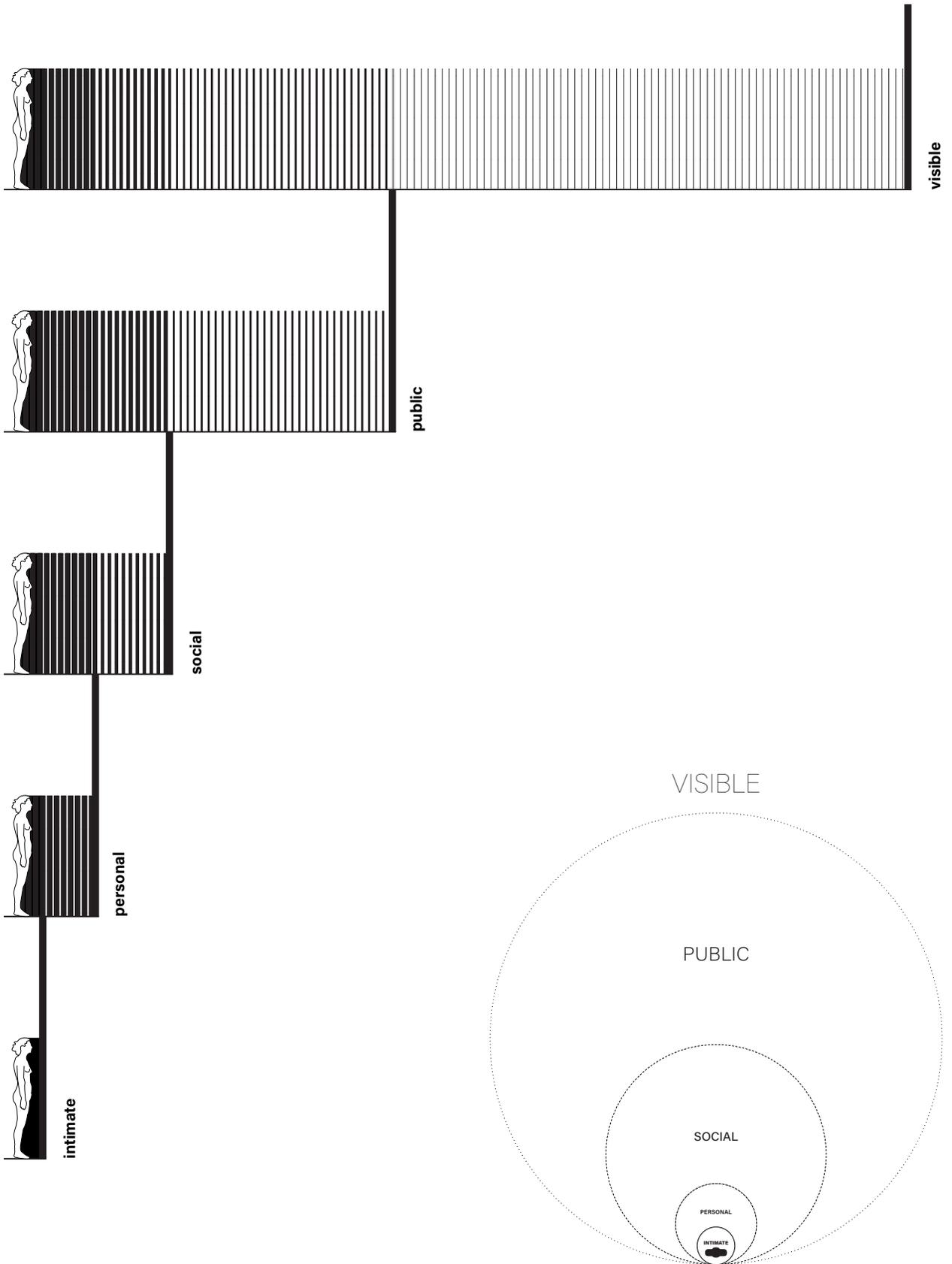


This far I described the two fundamental categories of space - Static and Dynamic, with a gradient of tonalities in between the two absolutes. The tonalities of static and dynamic space is informed by the factors of distance (spatial representation the time itself) and the speed as factor of technology, laws of nature and as such perception. Therefore we can conclude that the urban space is a system inherently static spaces connected via dynamic space. Essentially static brick and mortar space envelopes tied into an urban fabric via dynamic space that informs the nature of urbanism. Moreover we can state that urban space is fundamentally characterized as dynamic, meaning that a building can exist independently, while urban space is impossible without dynamic space that essentially informs it urbanity.

SYSTEM SPACE



Looking at the table of spatial nomenclature on the left we can see that as the space expands in size, the main defining element of space becomes the road that superimposed with the horizontal vector of urban quality becomes the least spatial attractive category of space as it most influence by perceptual factor of speed.

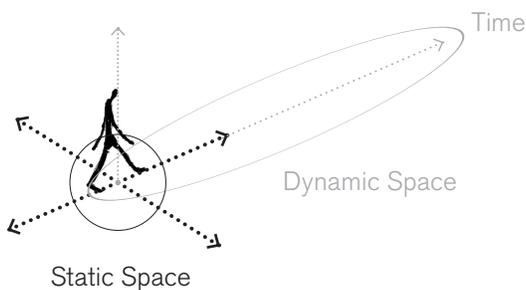


1 Horizontal Dimension



“Your sense of space isn’t just about knowing where things are, but also what they are.”

Groh, Making space.

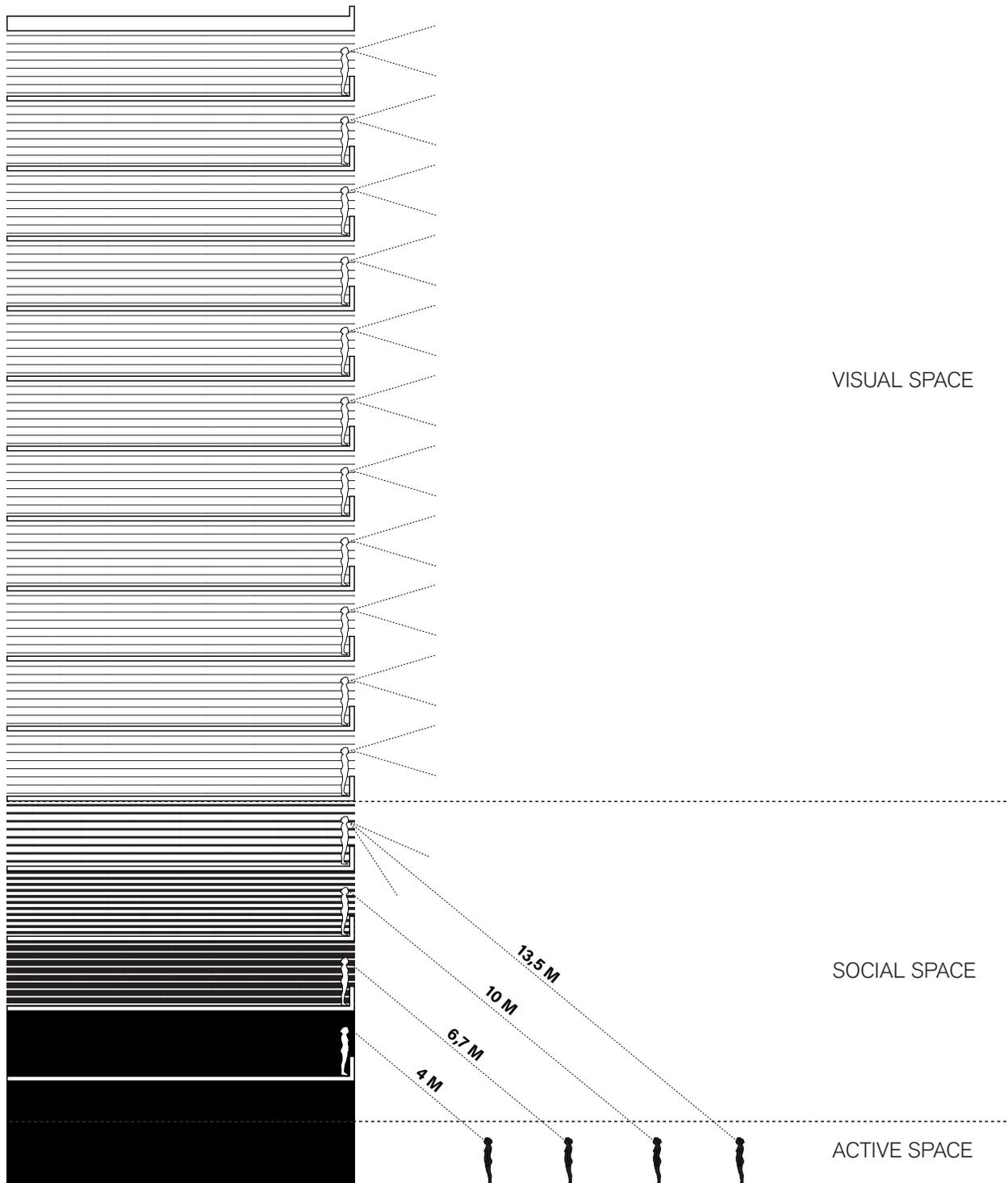


On the previous pages I described the fundamental nature of spatial medium - its visual and kinetic basis. Here I will continue the dissection of spatial medium in the four dimensional space-time.

The first and most primal degree of space as it perceive by us is its horizontal component. Human body exists and is primarily designed for the operation in two a dimensional horizontal space. Urban space reflects it as continuation of our physicality. Here I would like to claim that the same laws of proxemics that Hall attributes to the social space informs our relationship with the urban space as a reflection of social forms on the urban form.

The drawing on the left depicts the perceptual gradient between our sense of personal space and the street wall that contains and thus directly influences the social life and the perception of space in the horizontal action space.

*The drawing in build on the ideas
of Jahn Gehl, Cities for People*



2 Vertical Dimension

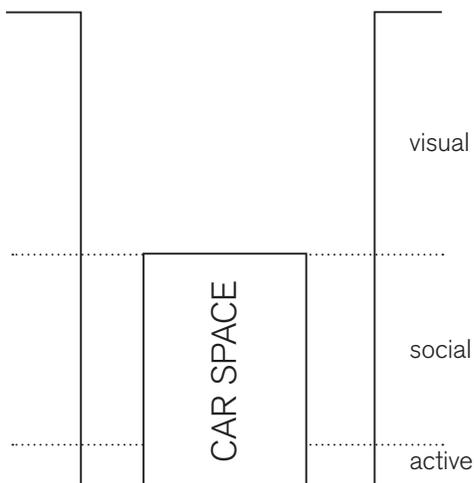
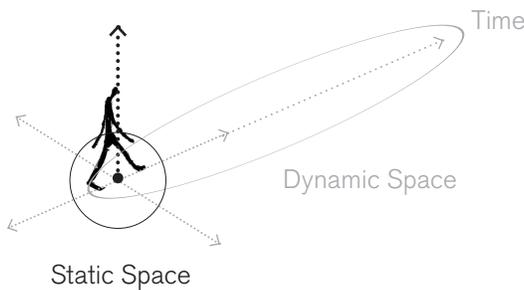


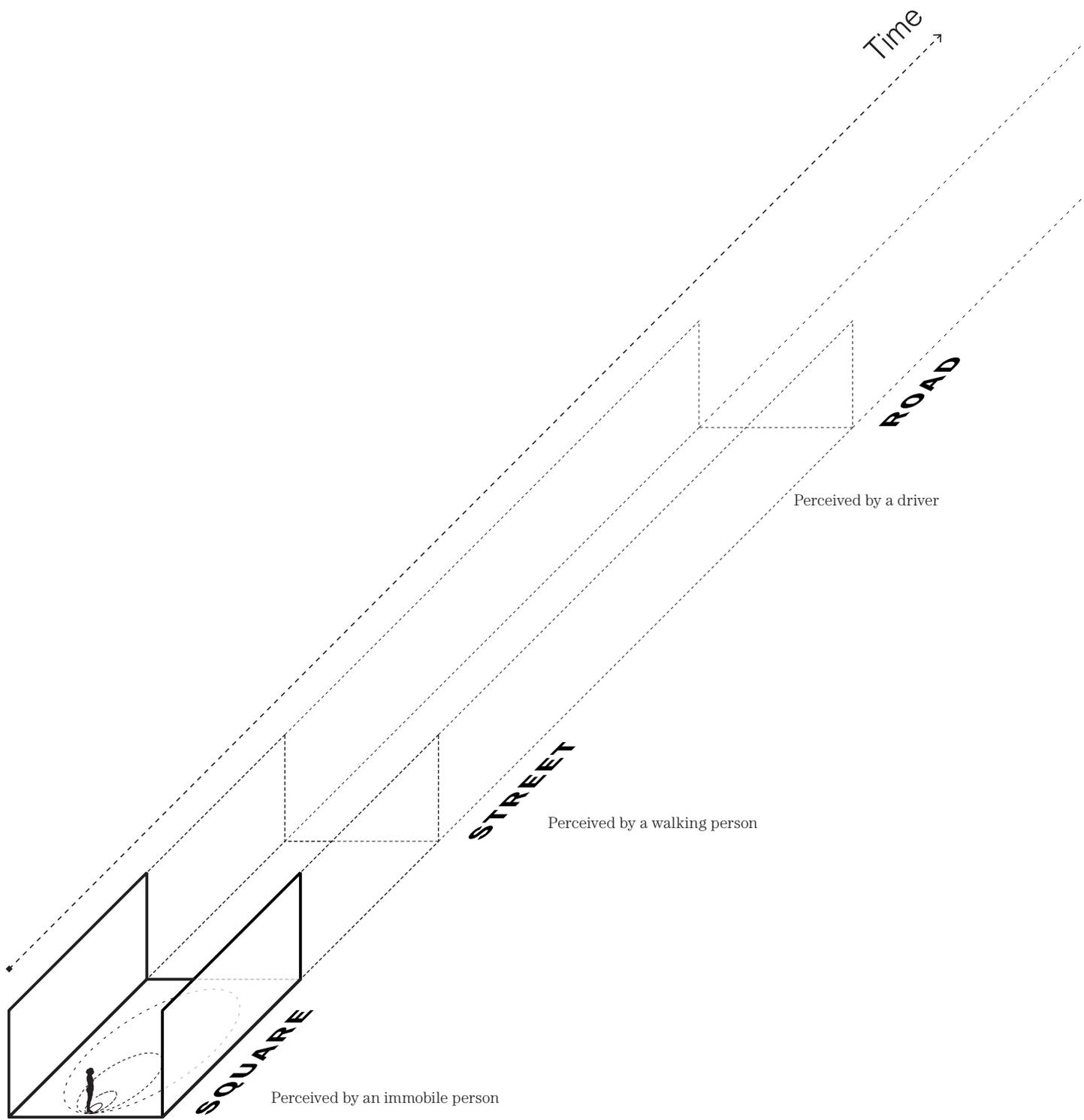
The second dimension of the primarily static urban space that I analyze vertically.

I would argue that Vertical is an artificial dimension of space. Before the invention of motorized elevator the access to the vertical dimension was limited by our physicality, and the access to the visual space that verticality provided was limited primarily for the use of defence, alarm, or an exhibition of power.

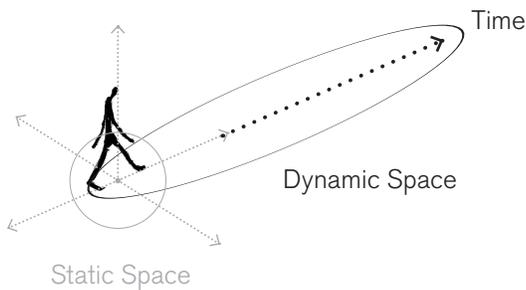
Vertical Dimension is the a fundamental product of technology that affected our understanding of contemporary urban space and living in density. However staking the horizontal space vertically significantly affects our sense of social space that is bounded by our vision, and our ability to communicate in the action space.

The motorized vehicular transport further disjoint the verticality from the realm of social space by its infringement on the active and social space of the street space. Therefore, it is crucial to reconsider the vertical dimension in the future of urban space





³ Time Dimension

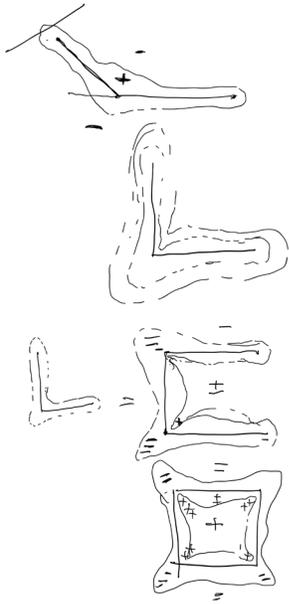


The third and the most important dimension of the urban space is time.

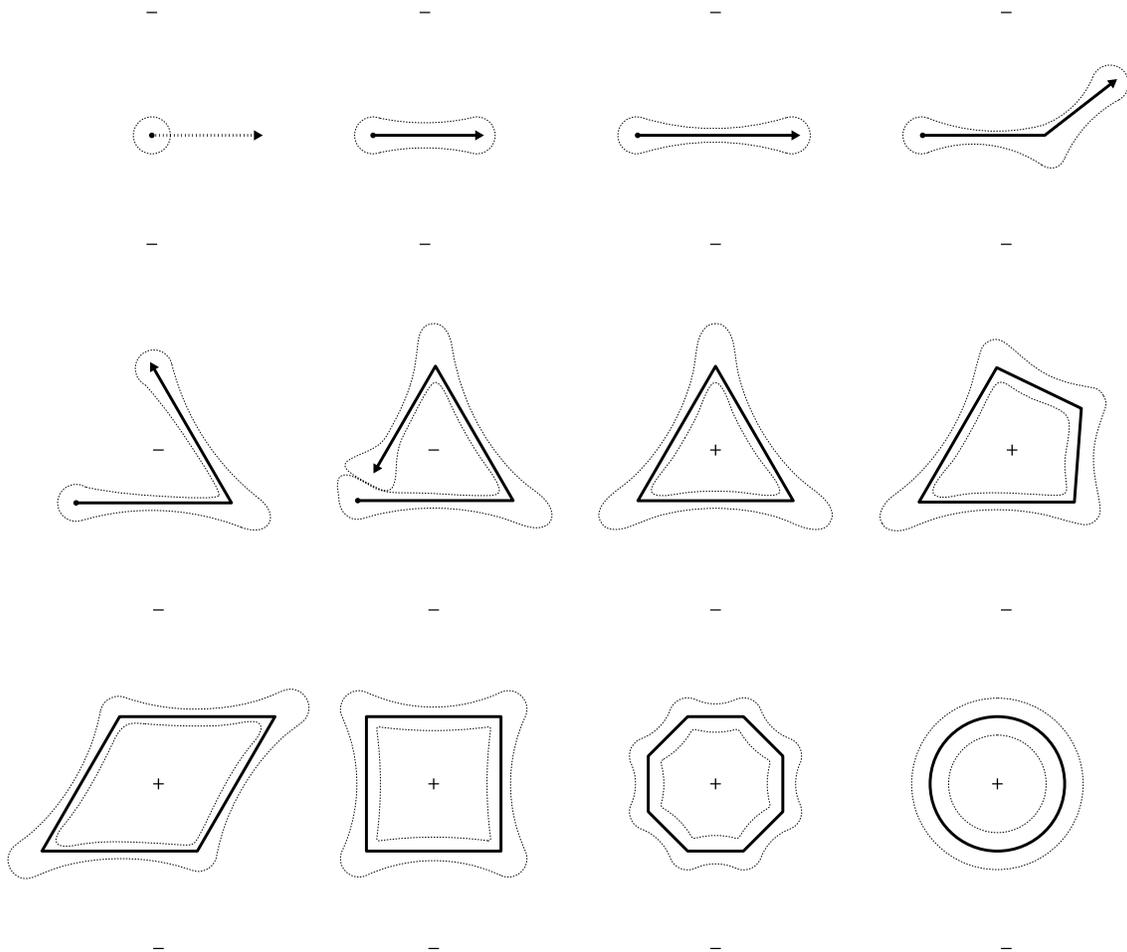
As the Verticality, the dimension of time is highly technological. Looking at the evolution of the urban space we can clearly see how the time dimension affected the form of the city and public space making is thin and porous.

The natural city, the city designed for the bipedal motion in space, invented the street as a multifunctional, dynamic, and spatial device for communication within an urban body. With the advancements of transportation technology, however, much of the natural function of the street as social and aesthetic space have been sacrificed to the necessities of ever increasing time dimension, where the street became the road, and the road became the highway.

This thesis attempts to re-imagine our relationship with the urban space-time, and offer an alternative to the current condition.



Spatial Gravity



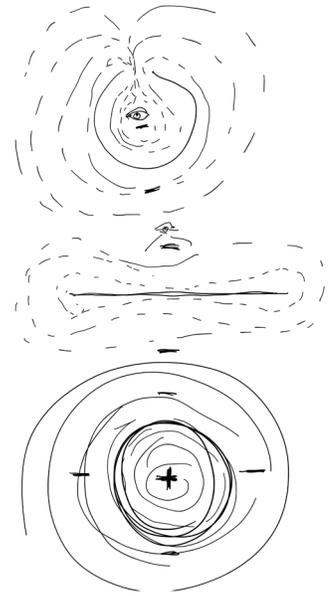
Defining Space



The next several spreads look at the inherent aesthetic qualities of space as formed by the space-time elements described above.

The diagram on the left combines within itself a spatial syntax, an alphabet of space-time expressed through the language of geometry. For the explanation of the aesthetic qualities of this particular syntax I would like to use sound as an analogy, where geometry of time-space takes on the sound characteristics of volume, rhythm and clarity, that corresponds to negative-positive space, kinetic flow, and spatial definition. Forming of what I understand as visual gravity of space.

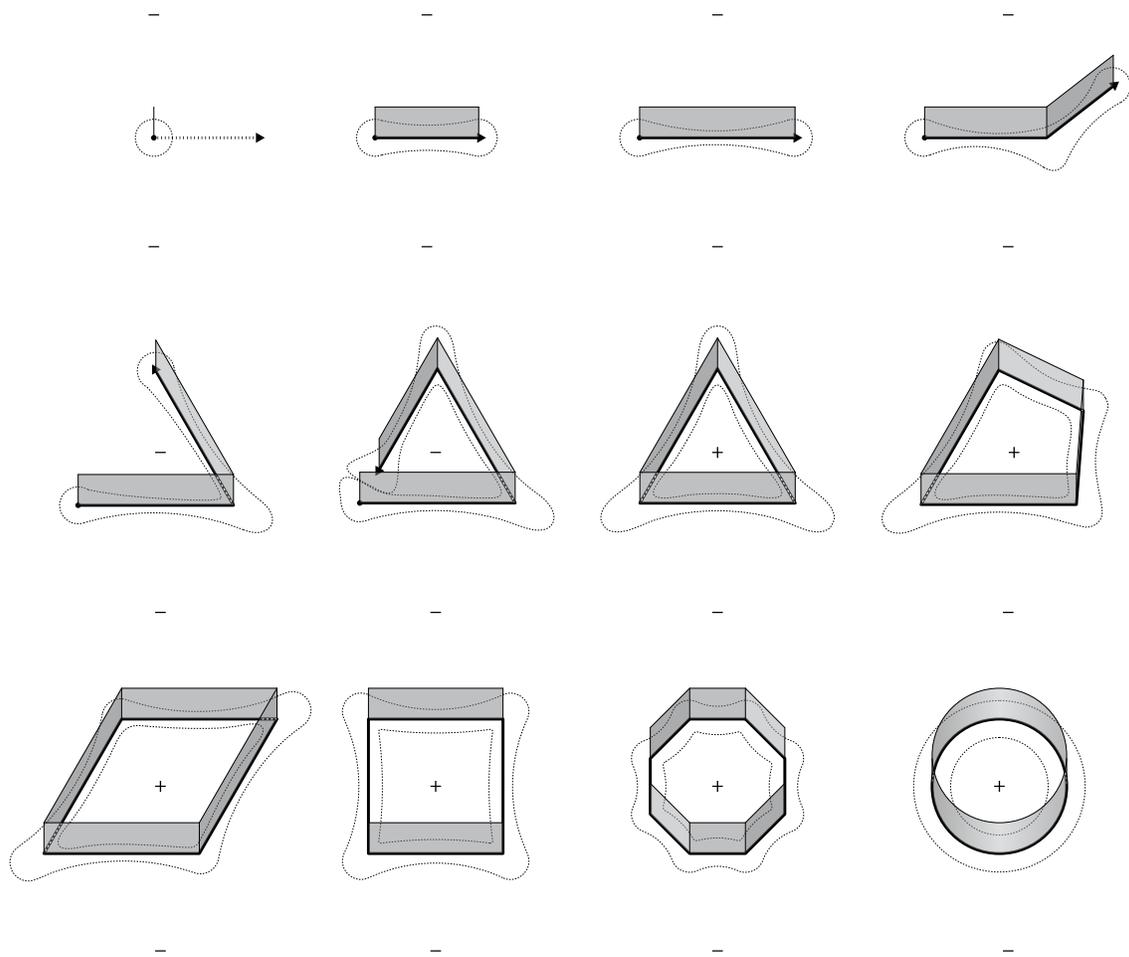
I start with a basic sound of freestanding column like object, as it produces radiated sound around it. As I apply rhythm to this basic spatial node I would receive a sound

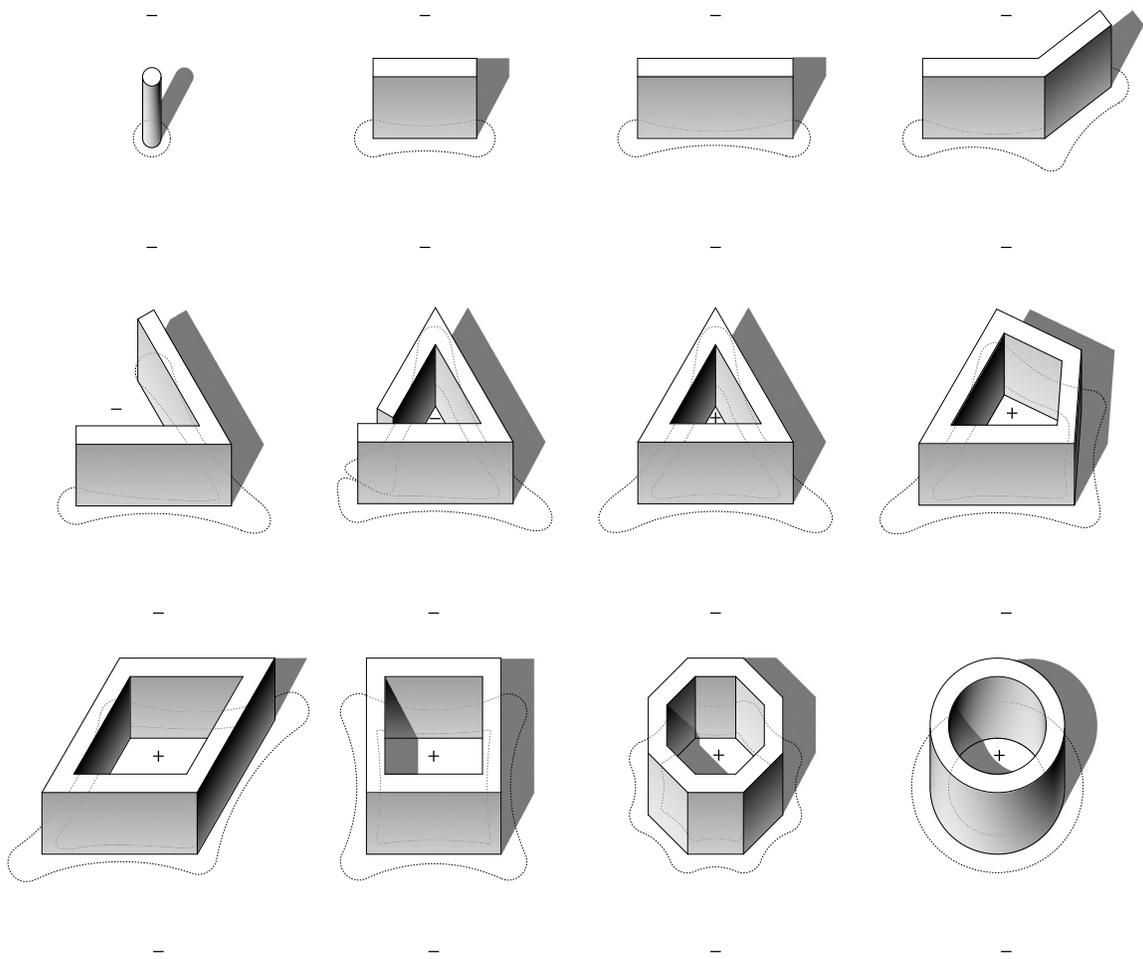


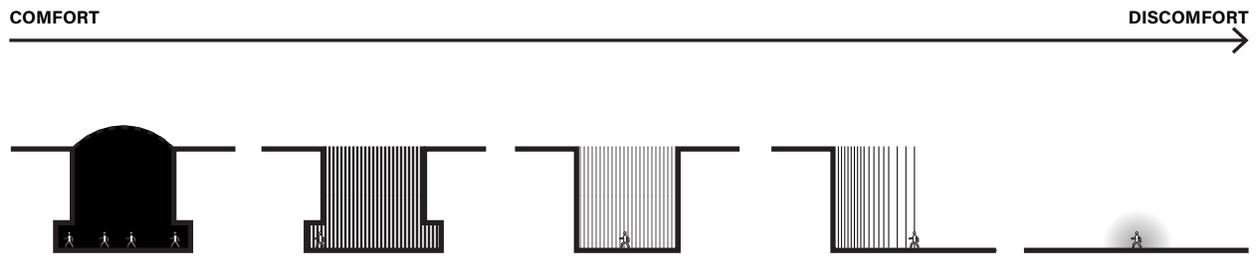
Positive & Negative Space

of varied volume where the beginning and the end are the loudest. The longer the rhythm the lower sound it received in its center accelerating the flow of space along its path. The geometry of this path-rhythm as it bends and distorts increases the sound of space tangentially to the geometry of path-rhythm. As the the shape closes it starts to define the clarity of positive space. As the path approaches its closure the sound at the endpoint of the path increases and distorts forming an intense dynamic spatial flow between the negative and positive spaces. The closed path-rhythm beside the full definition of the positive and negative space defines the sub-sounds from within and without the circular path-shape is the most evenly sounding.

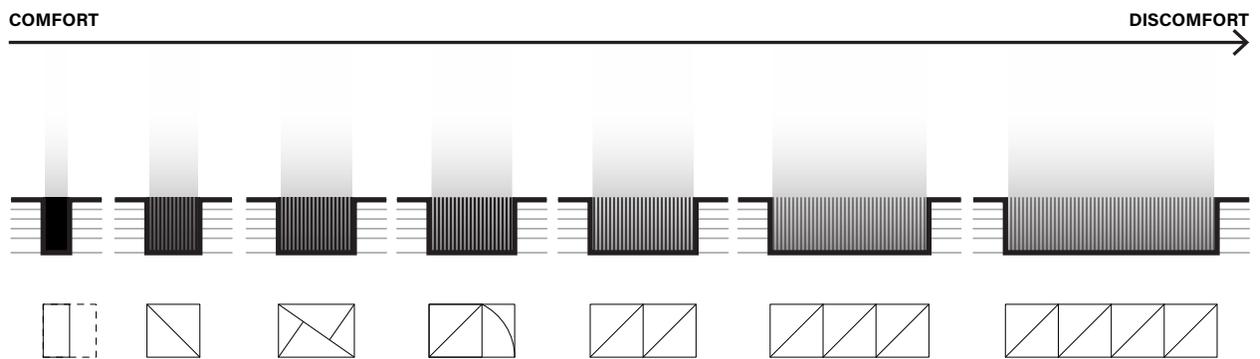
The next spreads show the space system of the closed and open, positive and negative spaces.







Gradient of enclosure



Relationship between street space and sky-space.

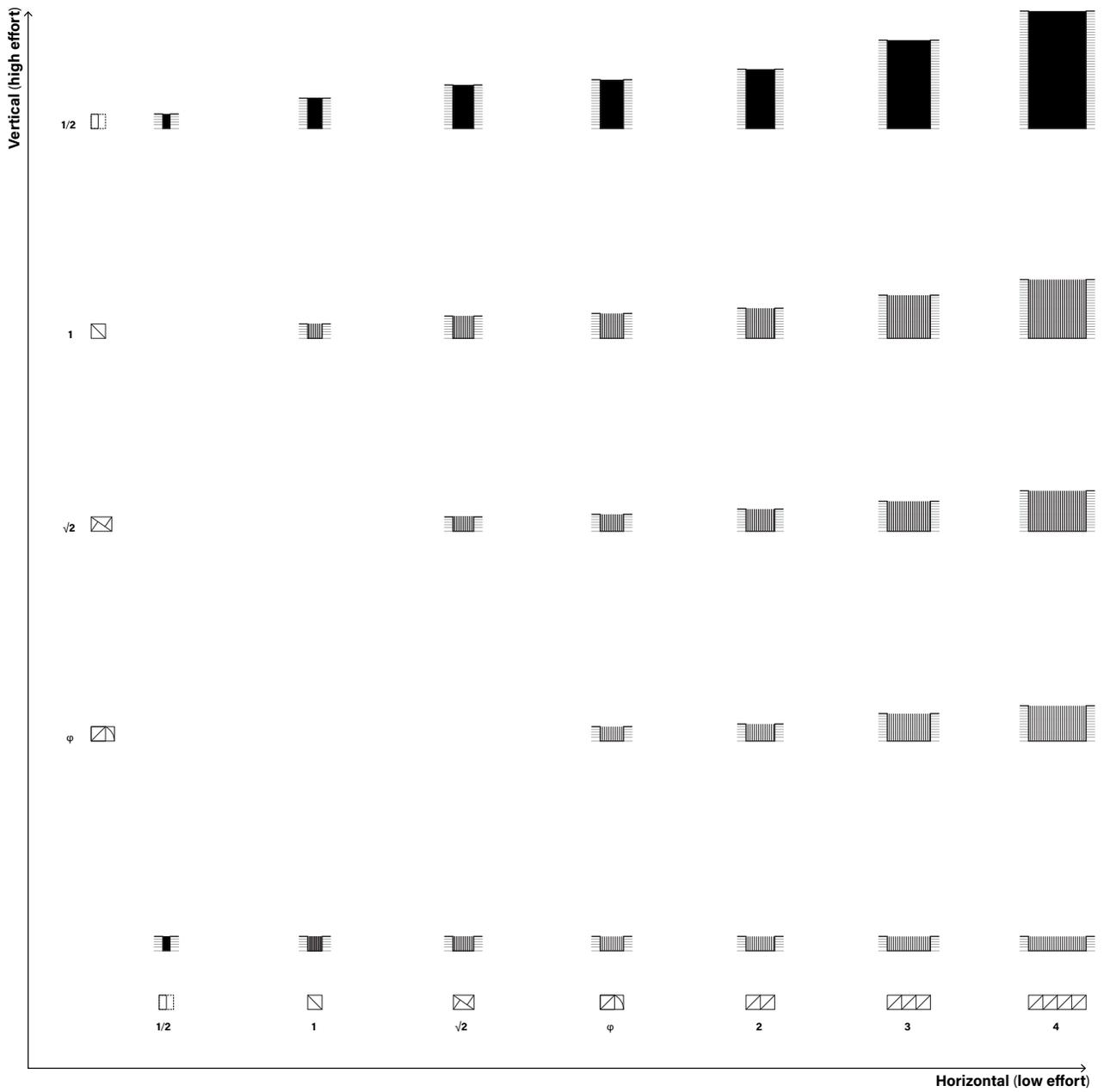
Aspects of Enclosure

While discussing the definition of space, I briefly looked at the relationship between the positive (enclosed) and negative (open) spaces. Here I would like to further expand on this matter considering also the positive and negative qualities of the vertical space and the aspect of the sky-space.

The top left drawing of the gradient of enclosure demonstrates the vertical gradient in terms of spatial comfort. Here I define the negative as least enclosed and positive as a most enclosed urban space.

The city as a system space should have a full gradient of negative (open) and positive (enclosed) spaces yet for the proper function of the action and social spaces the greater level of enclosure is preferred.

The gradient of the sky-space on the other hand has a purely aesthetic value certain abundance of visual space that can be used for visual connection the city through its vistas and time space.



Aspects of Space Proportions

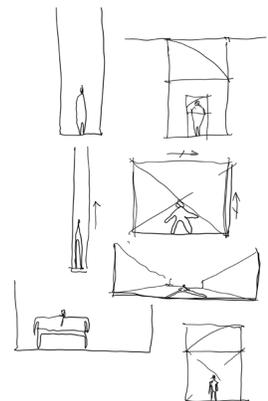
Previous pages demonstrated the space system as a system of gradients between well defined positive (enclosed) and negative (open) urban spaces. The chart on the left summarizes the proportional relationships between horizontal and vertical dimensions of space collected from the “Great Streets” book by Allan Jacobs.

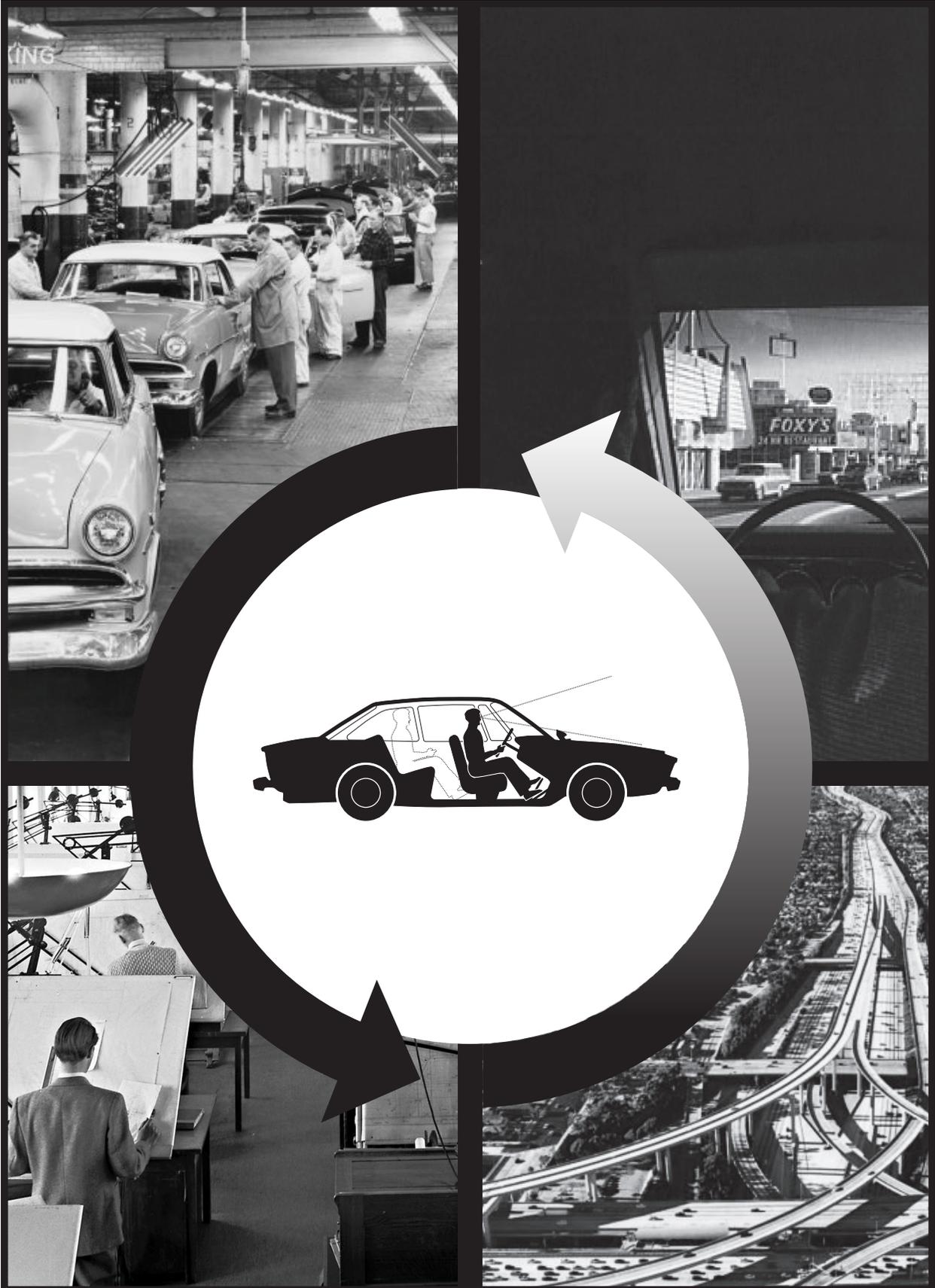
The bottom row of the chart rows a proportional relationships starting from one half proportion of width to height and progressing to the four to one width to height proportion, beyond which the space becomes undefined (majority of American Suburbs have a one to six proportion, which does not allow the formation of proper urban space).

The next rows demonstrate that the width of the street is not a defining factor in the proper definition of scale, Instead the proportion of the street wall to its horizontal spatial shadow is the key factor in the definition of space. In other words, the height of the street wall has

to be proportional to the width of the street. If the width of the street essentially forms an action space the size of which is determined by level of social activity than the height of the street has to follow the proportional relationship with the street width in order to properly enclose the action space. However the height of the socially active street wall must not exceed the verticality of the social space.

These conditions are purposefully abstract and simplified and do not consider the common condition of uneven street wall heights and the relationships between their spatial shadows.





TRAVERSE



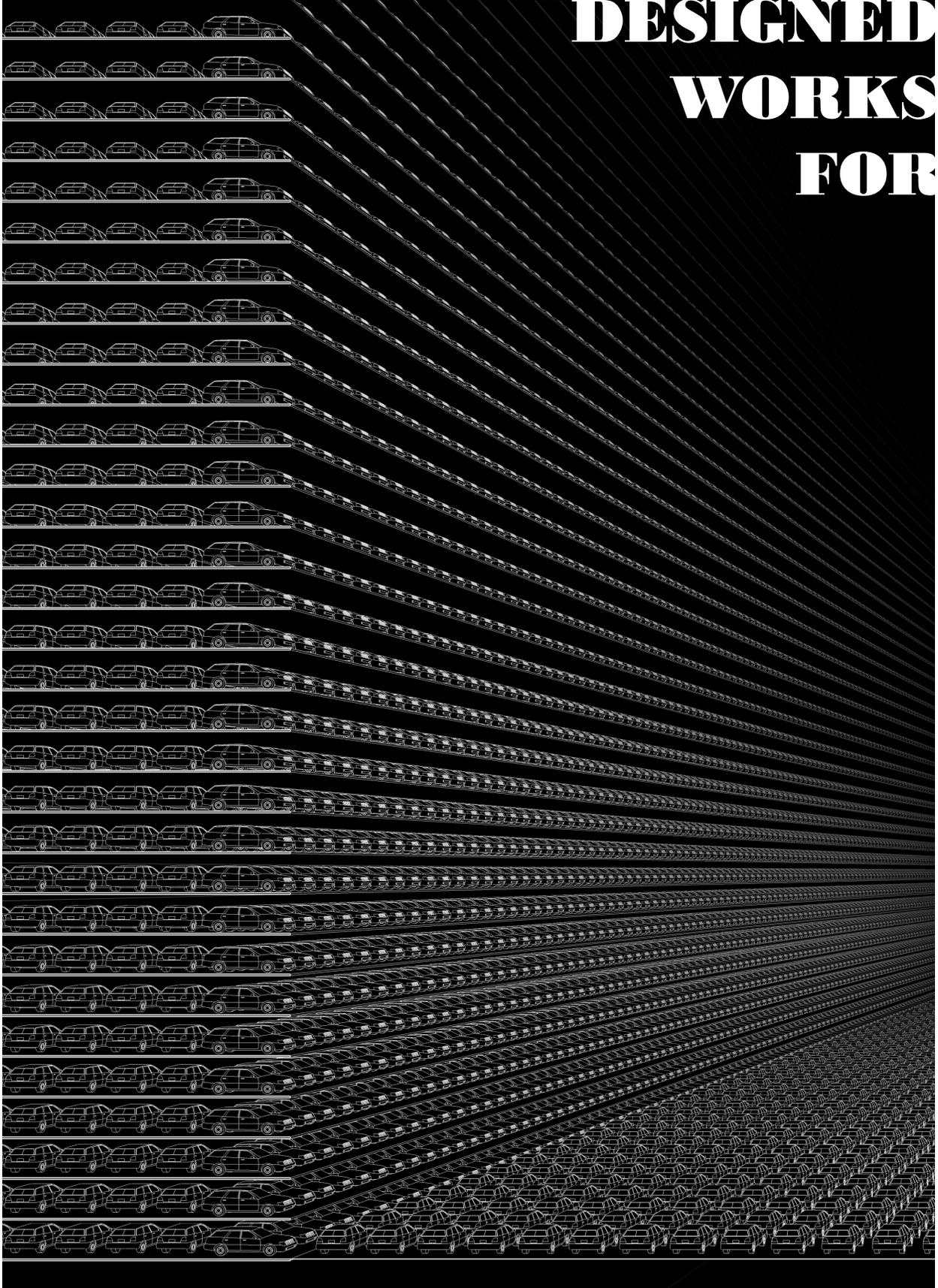
*The sensation of driving a car
is primarily one of motion and
space, felt in a continuous sequence.
Vision, rather than sound or
smell, is the principal sense.*

Kevin Lynch. The View from the Road

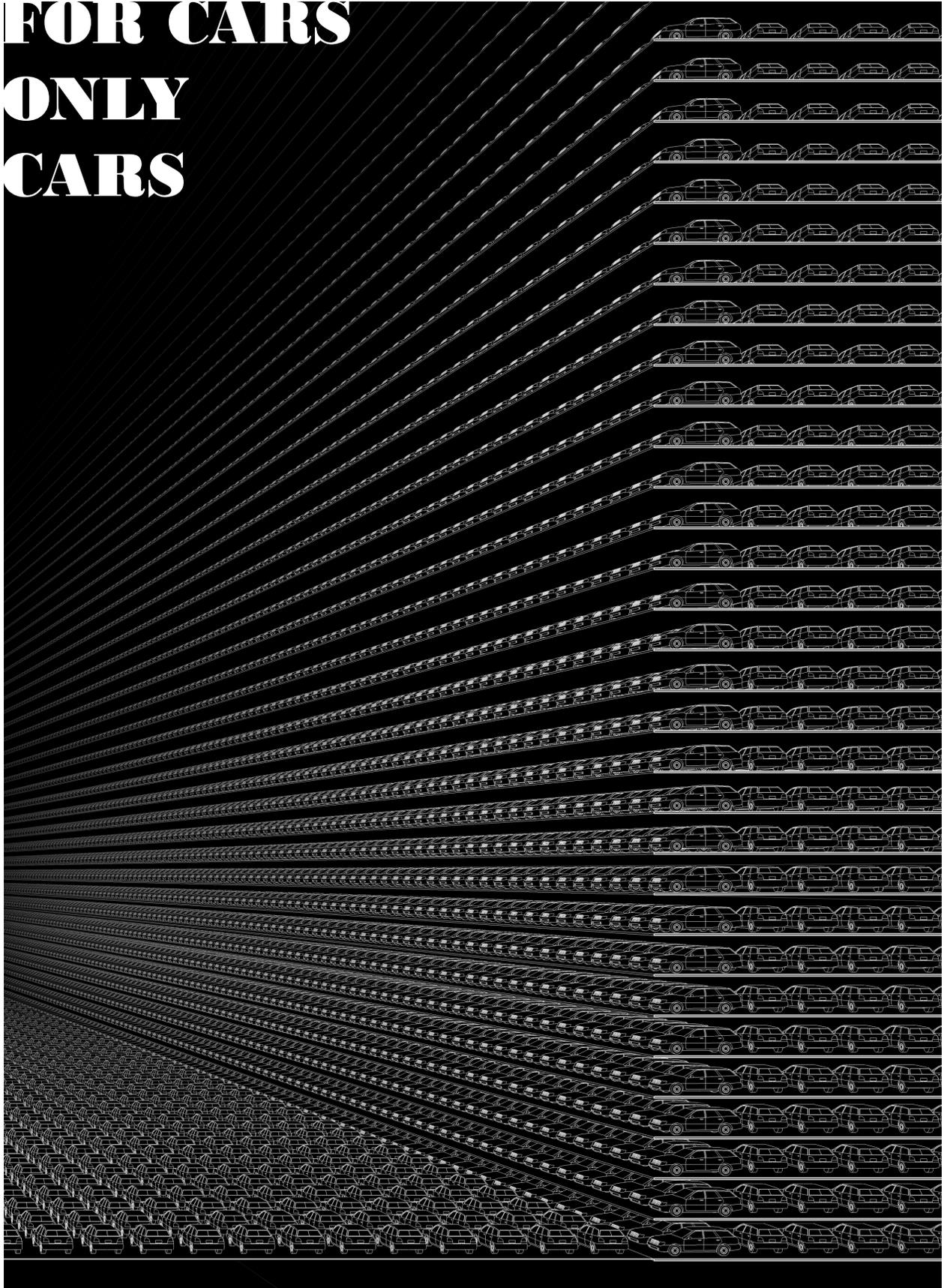
The first chapter looked at the relationship between static and dynamic space where I concluded that with the growth of the city its space becomes more dynamic destroying the value of space as an aesthetic and social medium.

In this chapter I speculate on how we can slow down the perceptual dynamism of the urban space in order to renew the appreciation for its spatial and social beauty. Here is where, I believe, the new modes of transportation must step in. The car and quality urban space are inherently incompatible. In order to improve the urban space we need to improve the mode of travel through it.

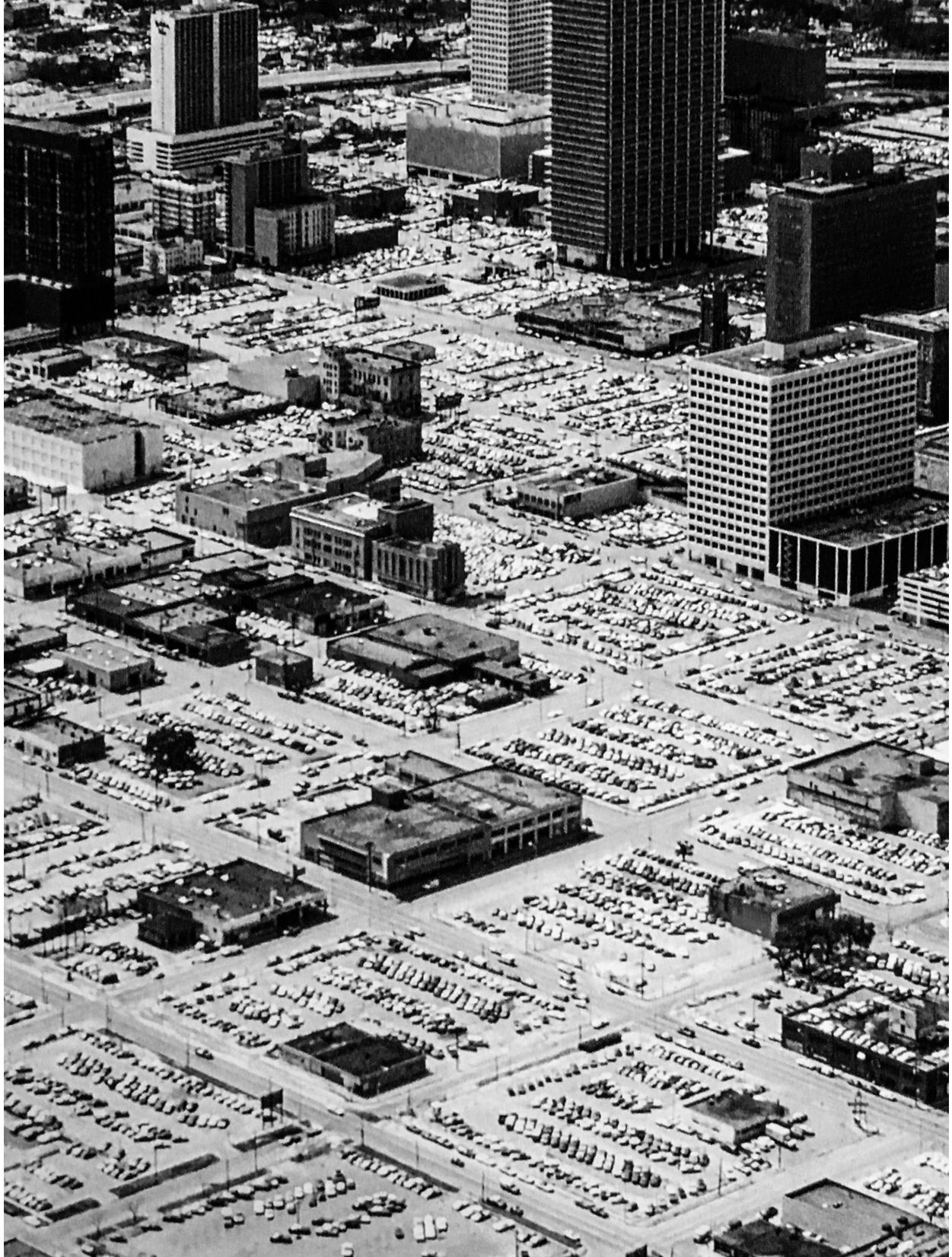
DESIGNED WORKS FOR

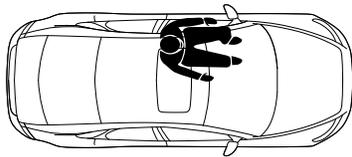


FOR CARS ONLY CARS

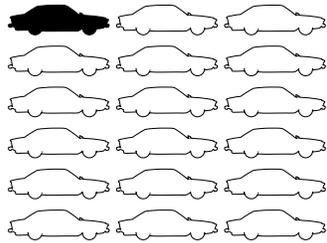


CITY IS NOT A PARKING LOT





85% SINGLE



95% IDLE



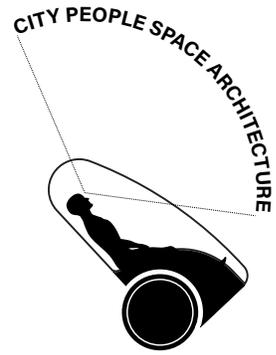
30% PARKING

< left

Houston, Texas, USA.



OPERATOR



FLANEUR



HUMAN-OPERATED
 COMMODITY
 PERSONAL
 UNIVERSAL
 REQUIRES PARKING
 REQUIRES MAINTENANCE
 COSTLY



AUTONOMOUS
 UTILITY
 SHARED
 SPECIFIC
 NO PARKING
 NO MAINTENANCE
 CHEAP

“Horizontal Elevator”



“Lets move the body not displace the body.”

Assessments indicate that already by 2020 driverless vehicles will become commonplace on the streets of many North American cities¹. By 2030, the number of fully autonomous vehicles is expected to reach 15 percent. According to the report prepared for the city of Toronto², autonomous vehicles will provide a number of benefits in safety, reduced traffic flow, support for travel for people with disabilities, reduced need for parking, improved comfort of driving, reduced of emissions and improved reliability of travel. A number of studies³ suggest a radical transformation potential of AV's on the public and shared-mobility within our cities. Yet, not enough have been done to predict the impact of this transformation of mobility on urban space and its perception.

The biology of perception⁴ proves that the speed with which we experience urban space and mode of such experience directly influences spatial perception.

It is the first time in the evolution of transport, that we can abandon the need of vehicle operation. Therefore, I argue that AV's have a potential to transform the driver into a neo - flaneur, a connoisseur of urban life and space.

In order to achieve this goal we need to reconsider the current role of personal vehicle. The car, a commodified extension of personal space, has to take on a new role of a shared machine that only facilitates movement through space a – “Horizontal Elevator”.

1 Robinson, 2016

2 Services, 2018

3 NACTO, 2017

4 Sekuler & Blake, Perception.

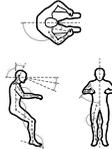
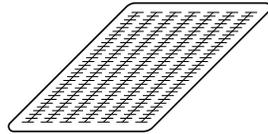
CAR

AV

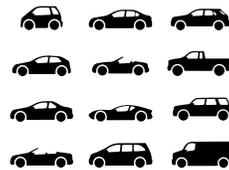
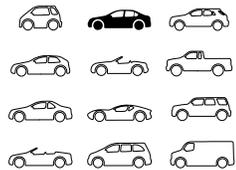
experience



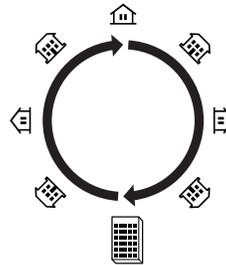
space



utility



mode



Human experience transforms from active engagement in the vehicle operation into a active engagement with the city life.

Instead of idle occupation of space in traffic and parking the AV takes the least amount of space necessary for a human transportation.

From personal ownership the car becomes a service utility allowing for a varied typology of vehicles available to a customer.

The point to point mode of operation, where a car spends 85% of time idling, transforms in to continuous operational flow.



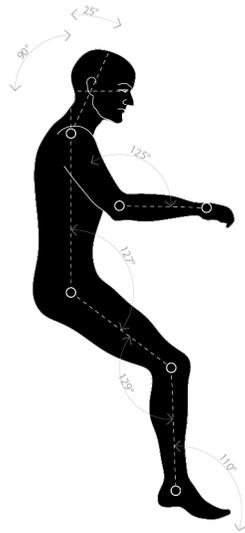
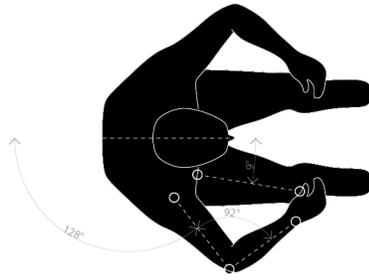
“Horizontal Elevator” Design

**“Car as a body extension
not house extension.”**

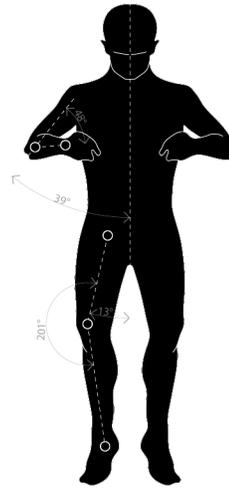


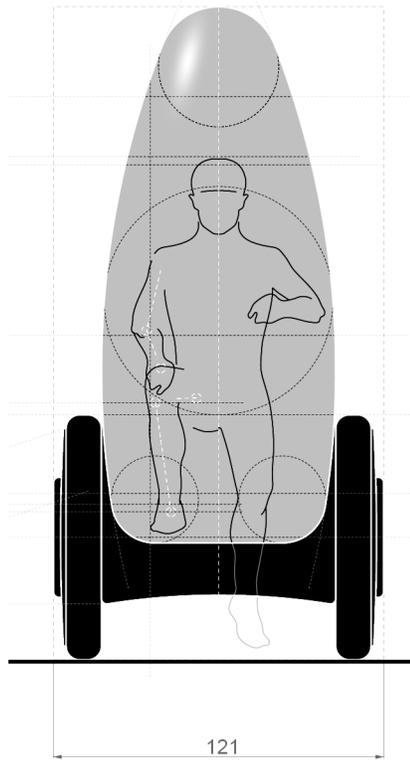
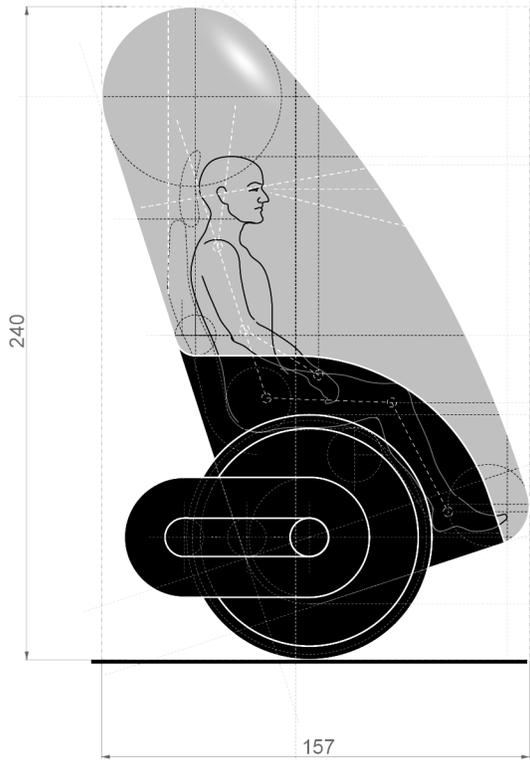
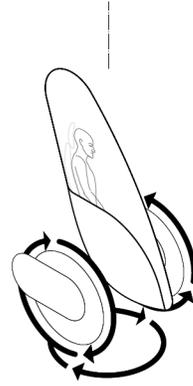
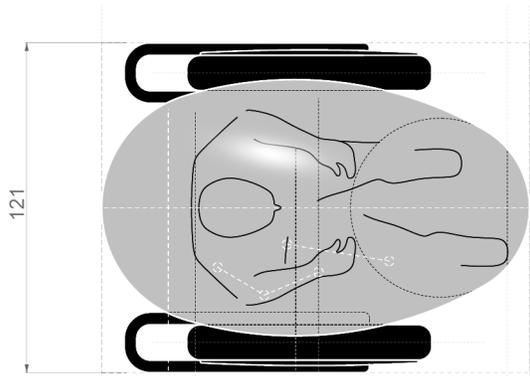
Design Sketches

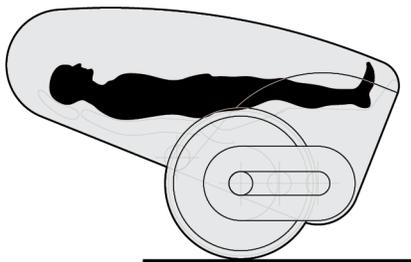
The design offers a new look on point to point transportation. The car becomes an extension of human body that provides minimal spatial envelope. Considering that the majority of car rides serve only one driver, the design sheds off the dead space for other passengers and remove the truck space as it potentially can be substituted via automated delivery. The combustion engine space is replaced by a minimal space of an electric engine. The envelope of the car is transparent offering an immersive experience for a passenger. The design also proposes a bi-wheeler self balancing set up that allow for a maximum maneuverability in the traffic flow. Autonomous operation and manoeuvrability allow for a shared use of roads space by passengers and pedestrians. The wind resistance of the car is adjusted by the car tilt from a horizontal position at the maximum speed to a vertical position for slow movement among pedestrians.



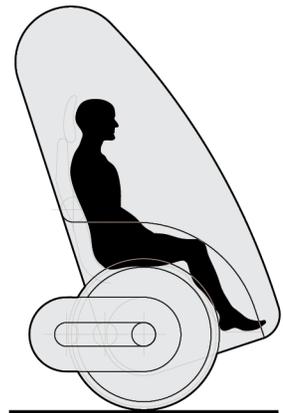
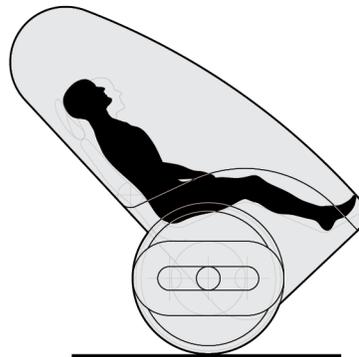
← 14° →





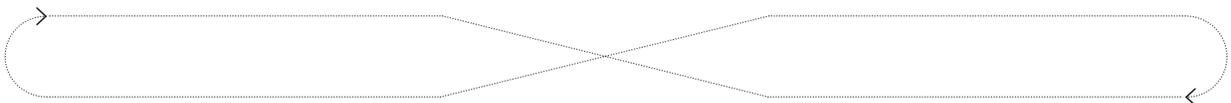


100 mph

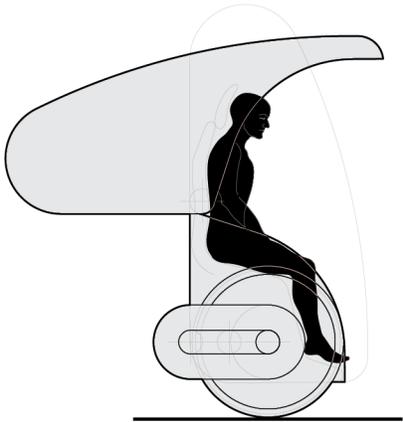


20 mph

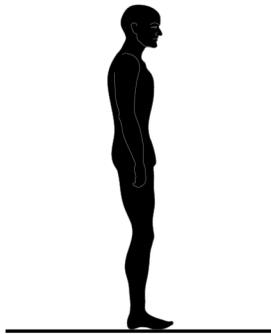
Speed



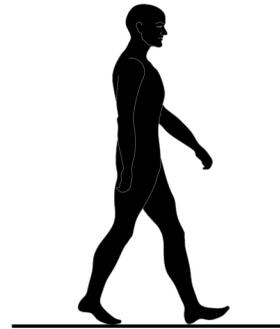
Urban Experience



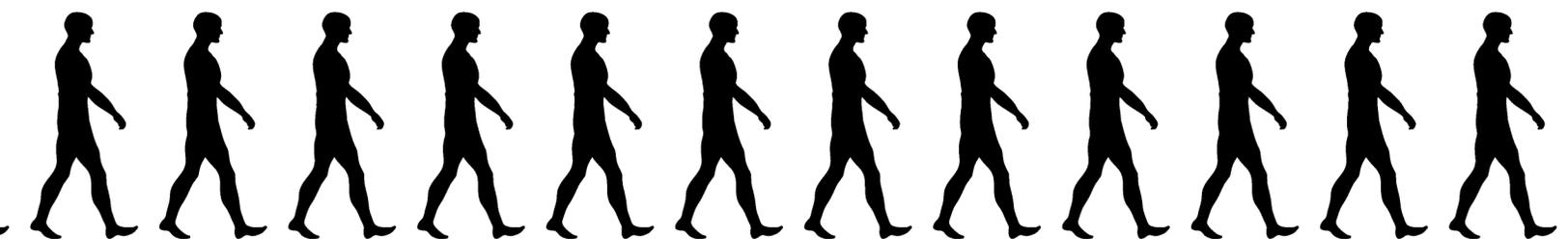
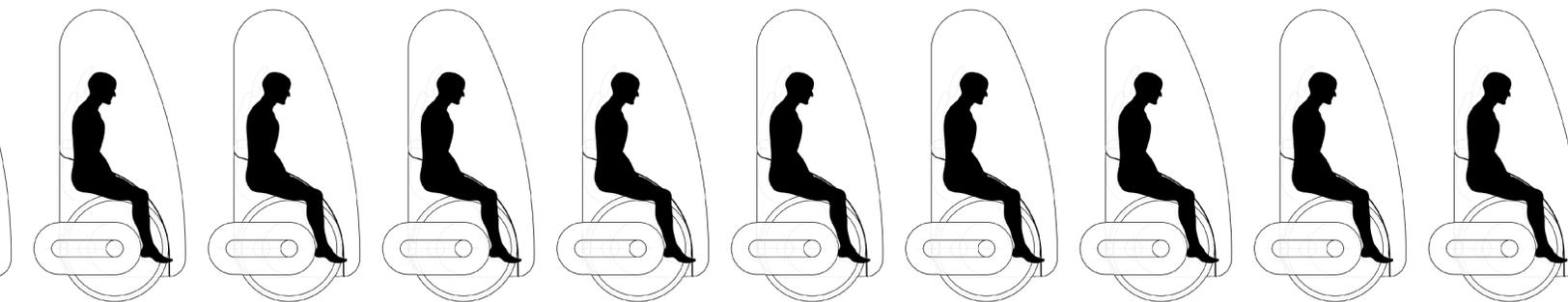
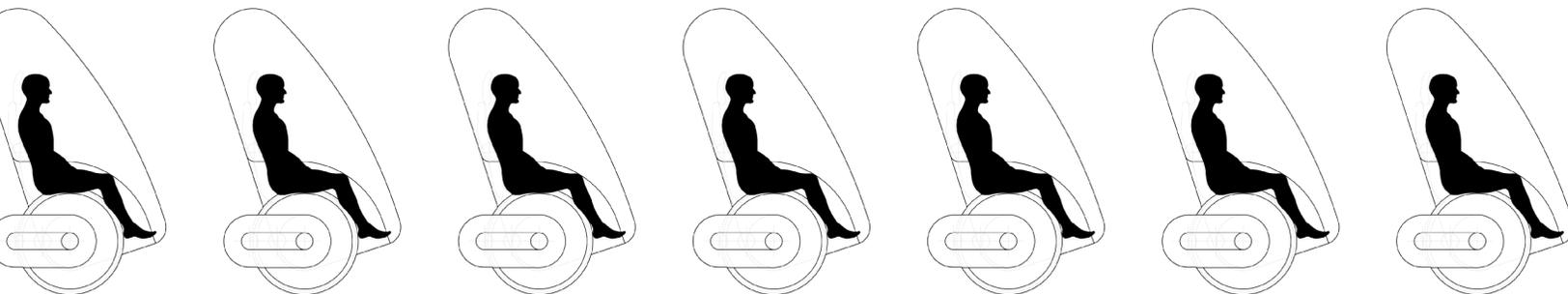
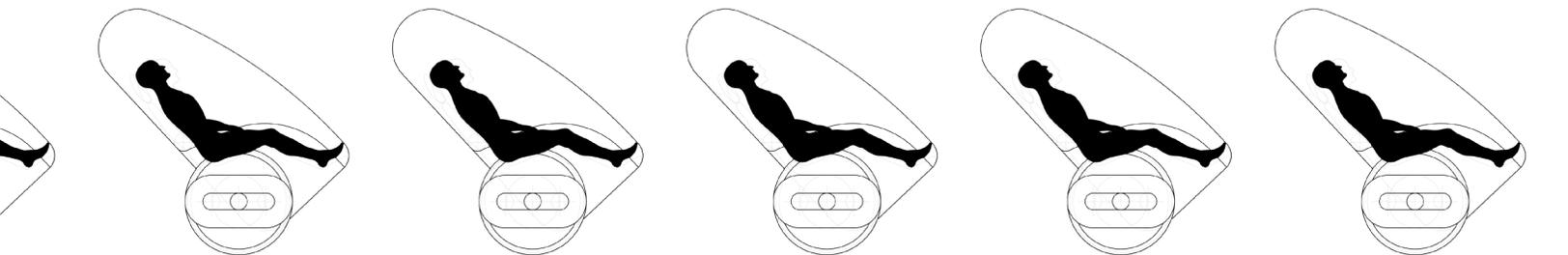
5 mph

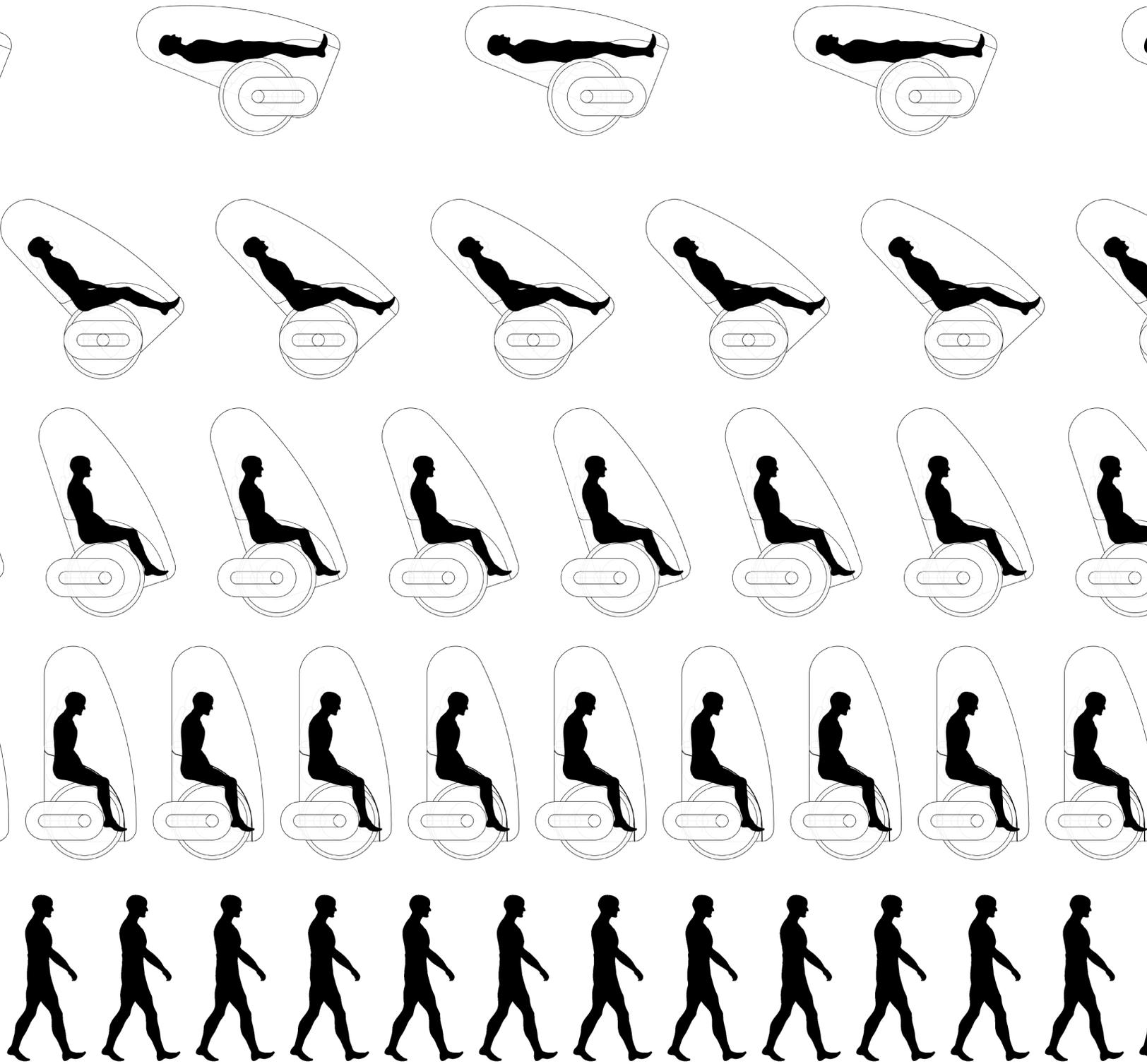


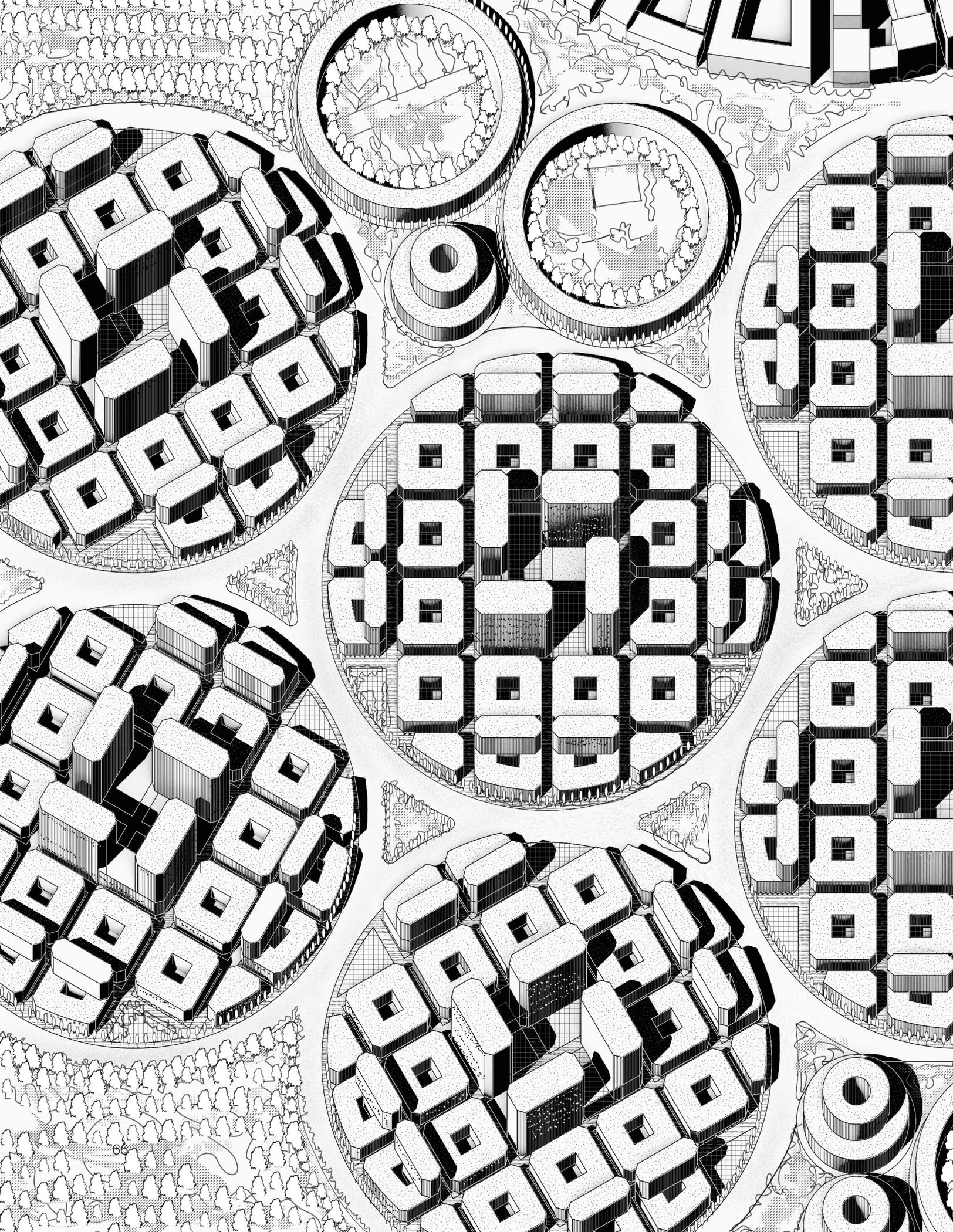
0 mph



5 mph







DESIGN

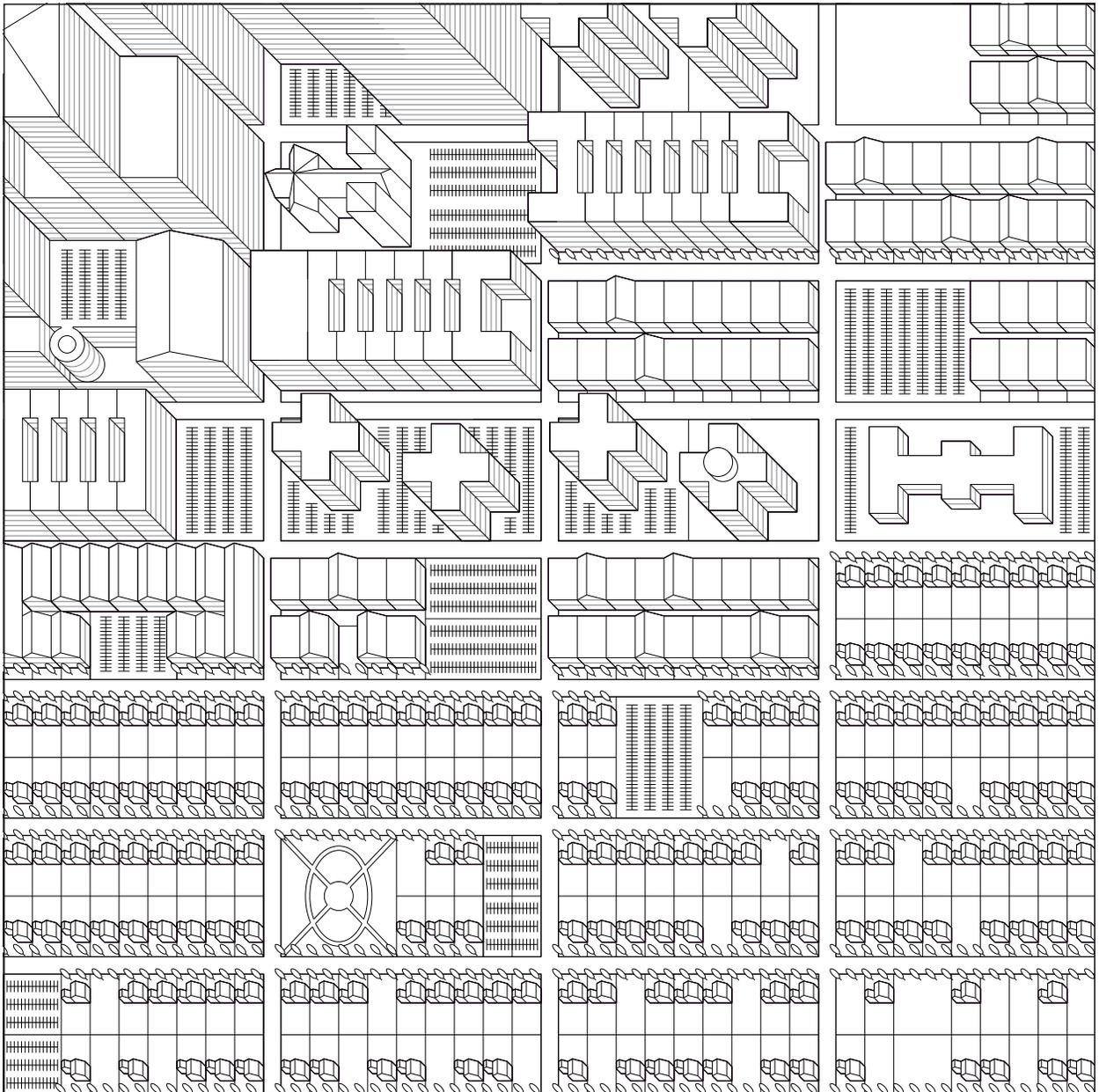


*Form is emptiness, emptiness is form
Emptiness is not separate from form,
form is not separate from emptiness
Whatever is form is emptiness,
whatever is emptiness is form*

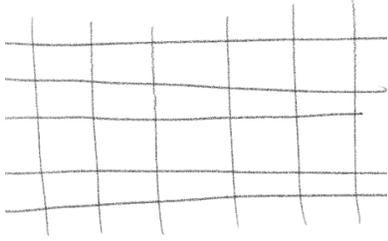
The Heart Sutra

This chapter summarizes the design principles and lays out the foundation for an Autonomous City Design.

Now

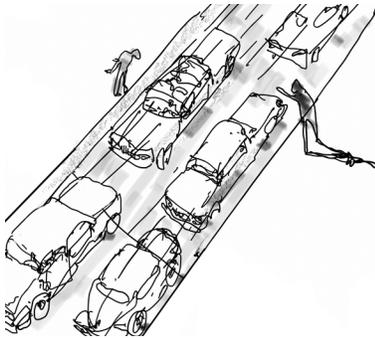


SPATIALLY MONOTONOUS



The current city has a limited spatial variety formed by the dynamic space of thoroughfares. The gridiron city of straight lines and intersections has a limited opportunity of spatial gradients.

UNWALKABLE



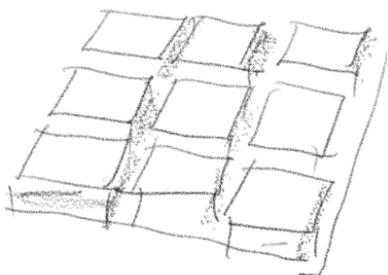
The coexistence of two modalities of city experience, pedestrian and motorized, inhibits the natural flow of both. The city space allocated for vehicular transportation does not allow a fluid pedestrian movement.

CAR CENTERED



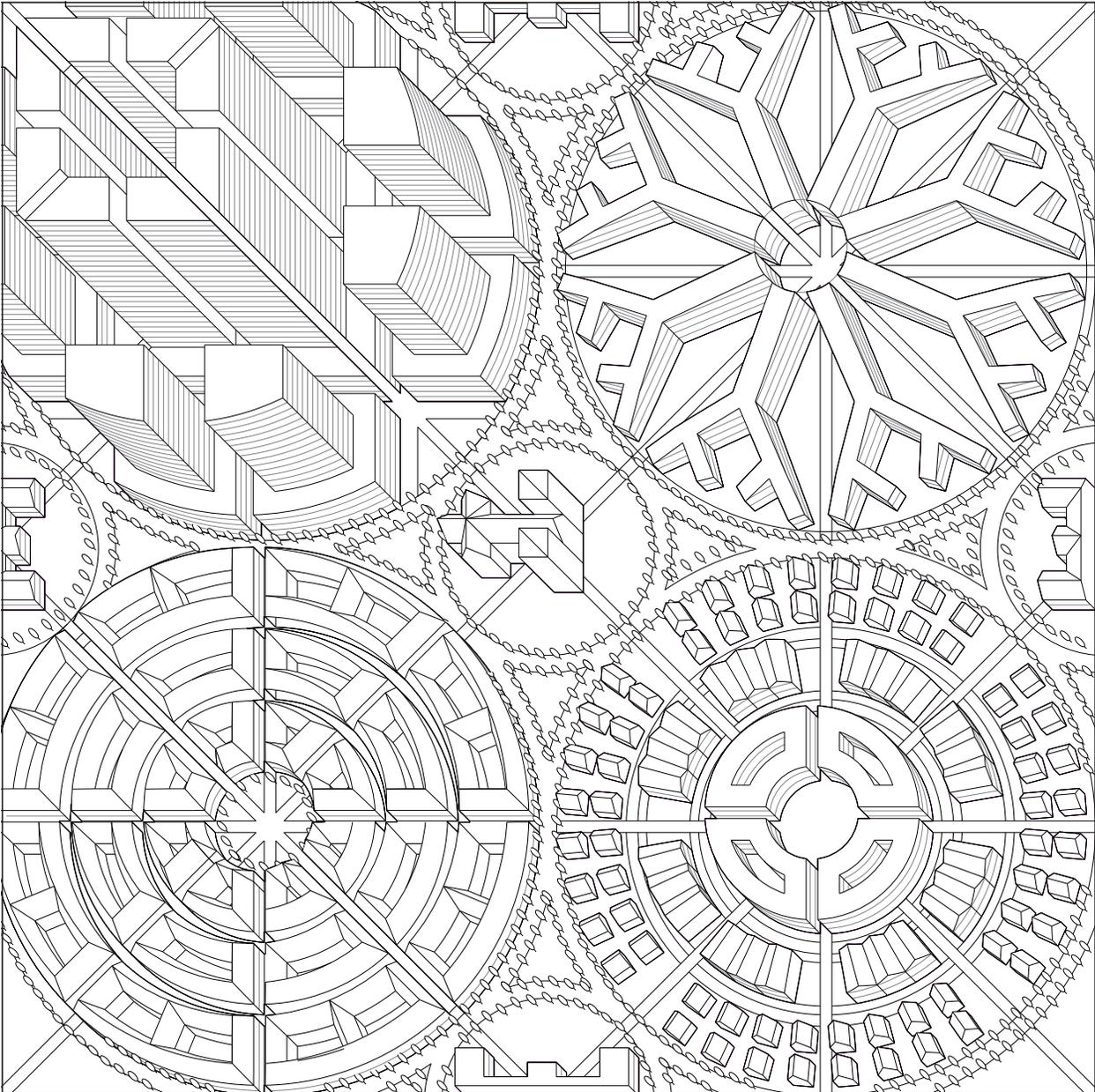
The pedestrian sidelined to the narrow sidewalks has a limited view on the city, while the driver is distracted from the full appreciation of the urban space.

INTROVERTED / PRIVATE

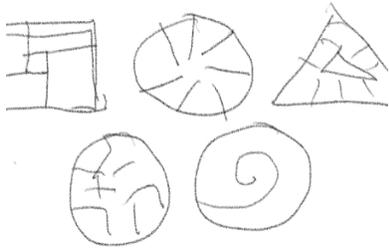


The building fabric of the “Non contact” city is concentrated on the building interior experience sidelining the public function of the city interior

Future

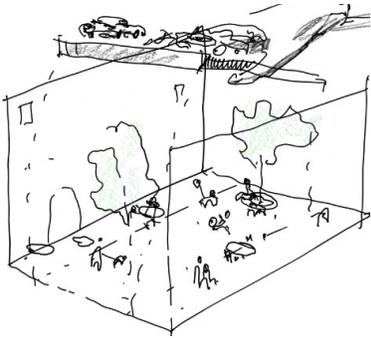


VARIED IN SPACE



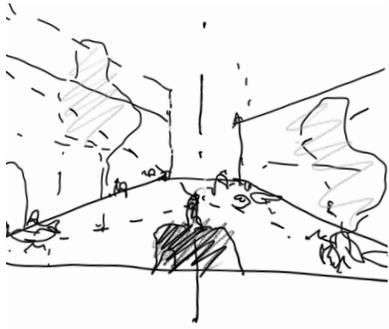
The greater walk ability and the emphasis on the shared use of urban space between pedestrian and passenger created an incentive for a varied spatial experience.

WALKABLE



The street returns to the pedestrian and become a venue of social life and urban activities.

PEOPLE CENTERED



The pedestrian becomes central not only in terms of movement in urban space but also in terms of aesthetic experience of the city spatial and built fabric.

EXTRAVERTED / PUBLIC

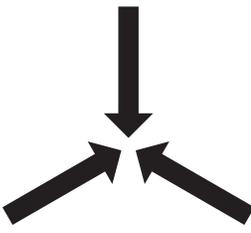


The public interior becomes as important and as the private interior forming a hierarchy of public space.

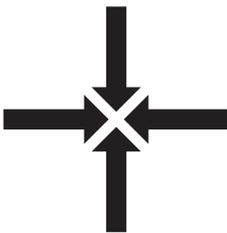
Changes in Form



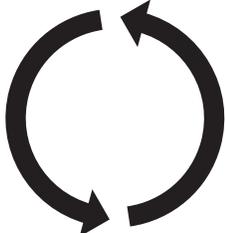
Road
0 junction



Hex Grid
3 way junction

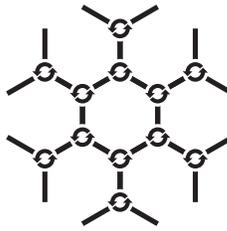
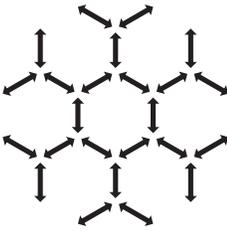
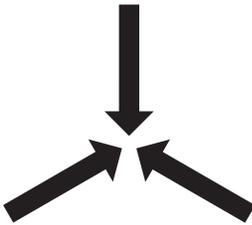


Cartesian Grid
4 way junction

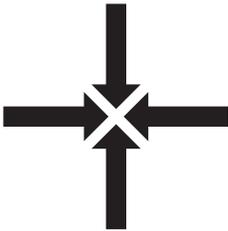


Round About
∞ junction

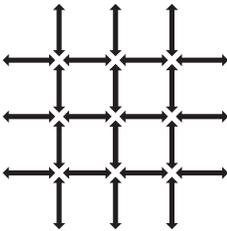
Hex



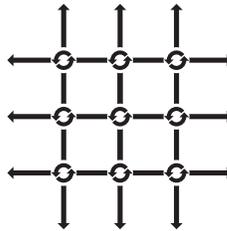
Cartesian



Junction
0 junction



Traditional
3 way junction

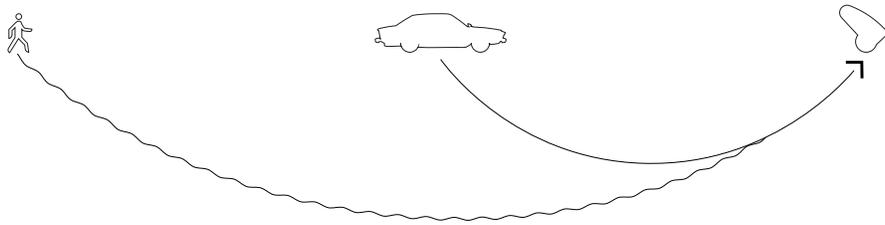
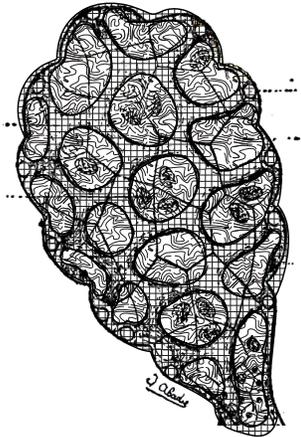
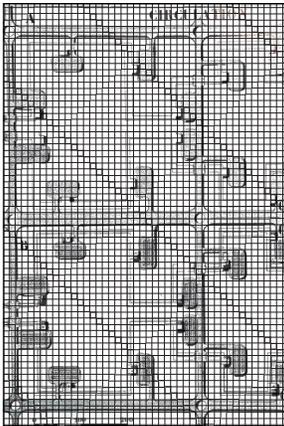
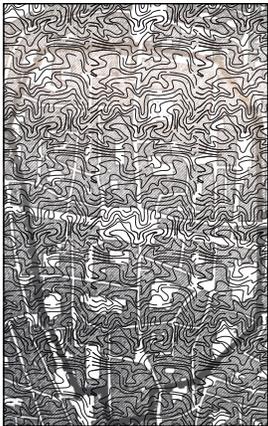


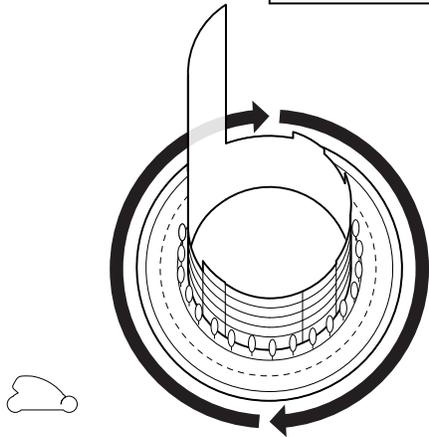
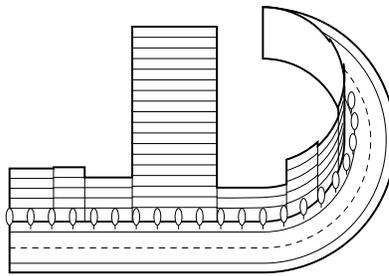
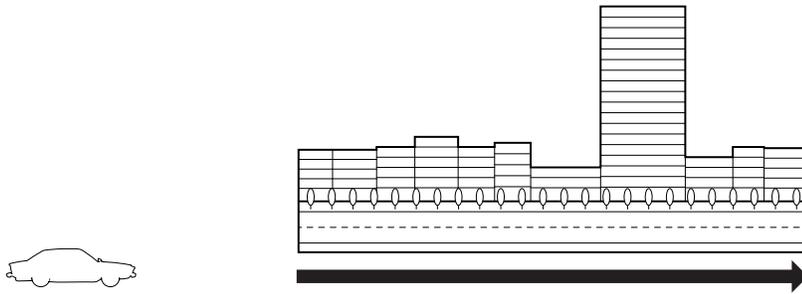
Roundabout
intersections

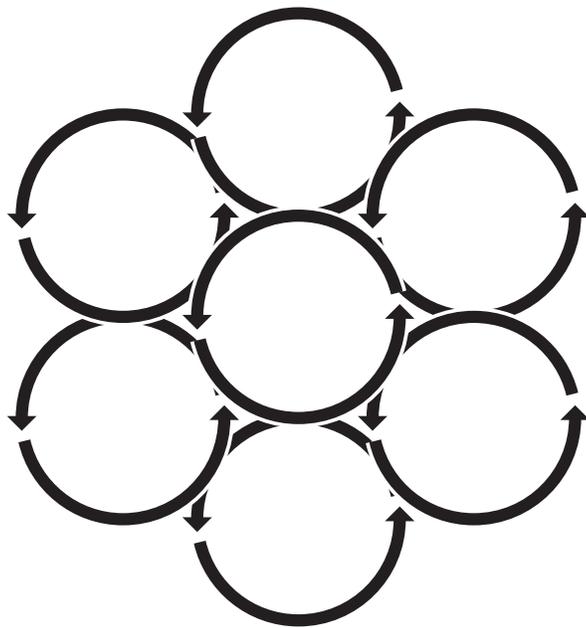
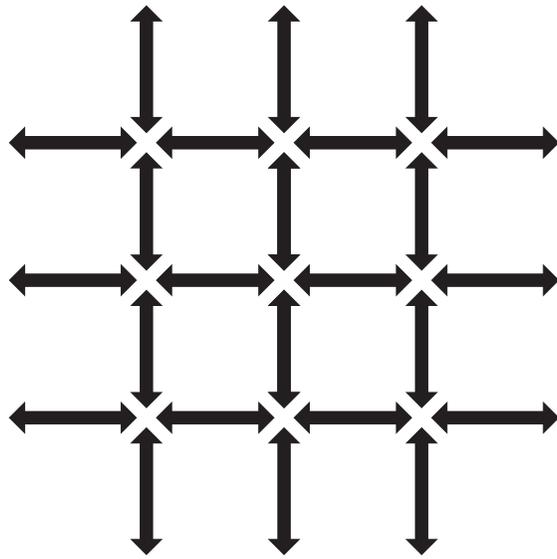


Roundabout Grid

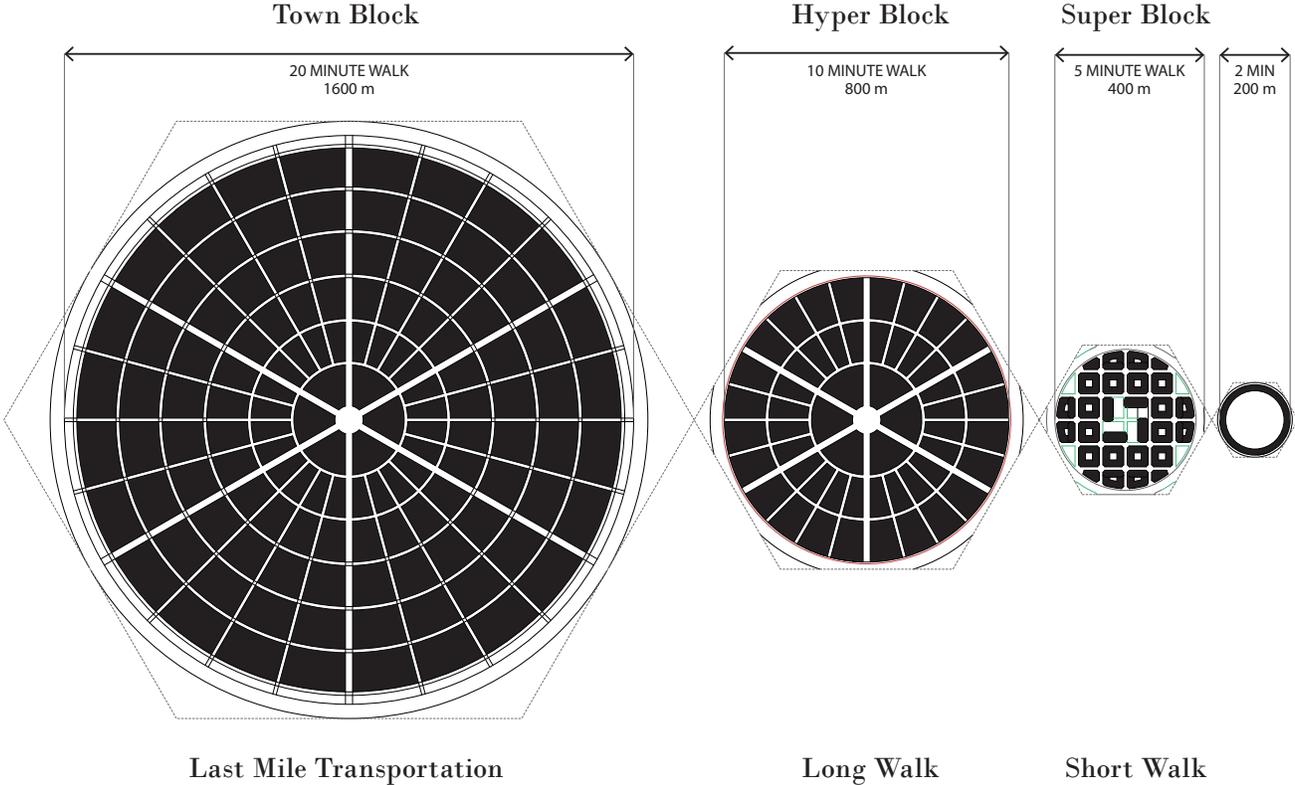
Walkable City



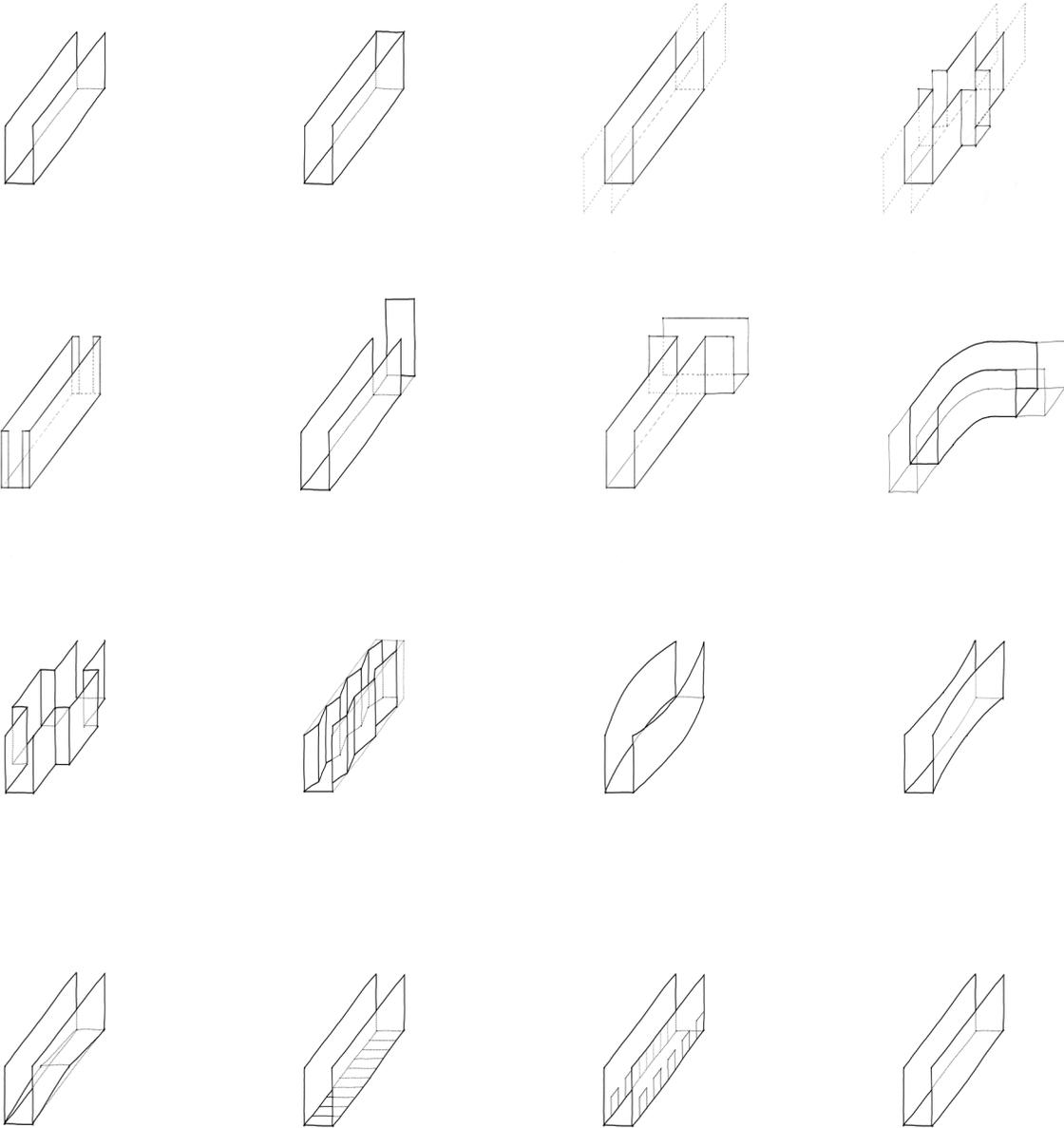


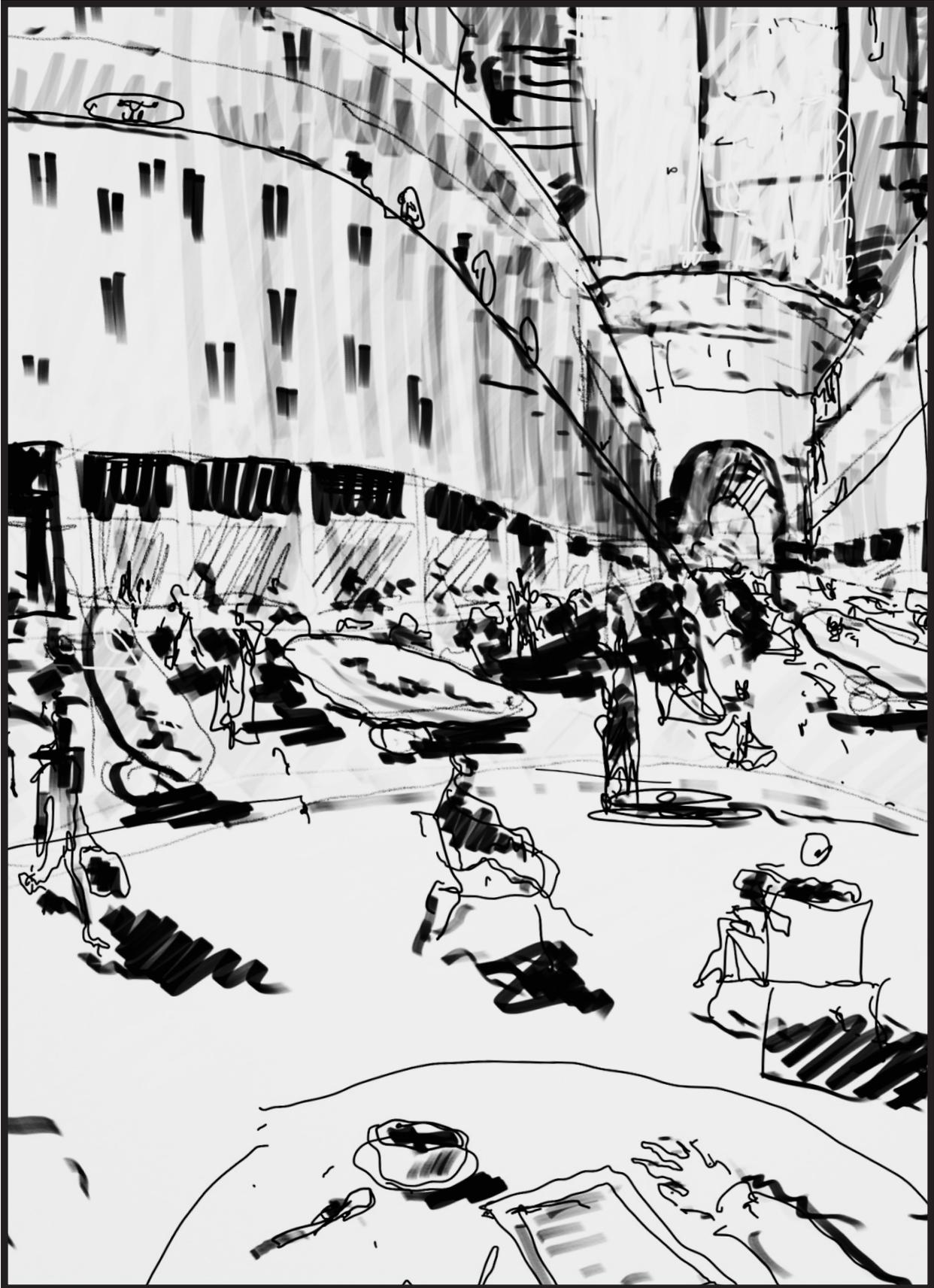


Block Sizes

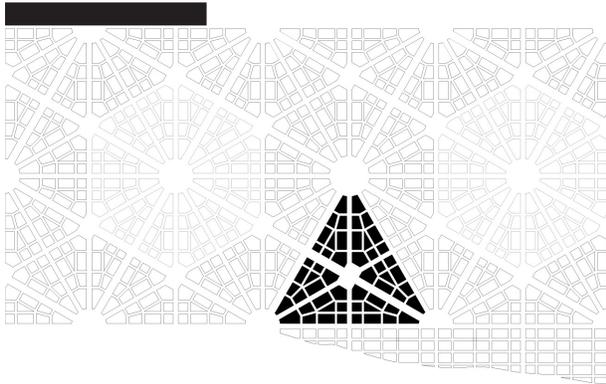


Slowing down Dynamic Space



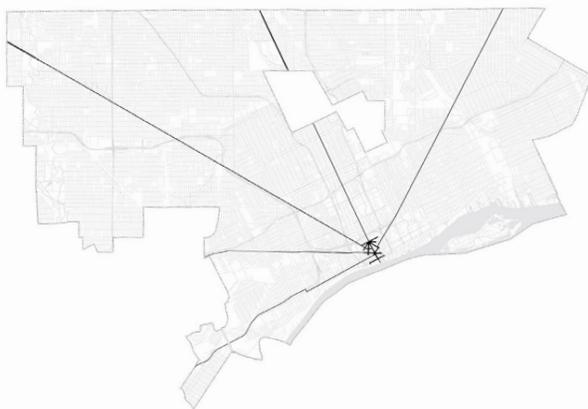


Re-Detroit



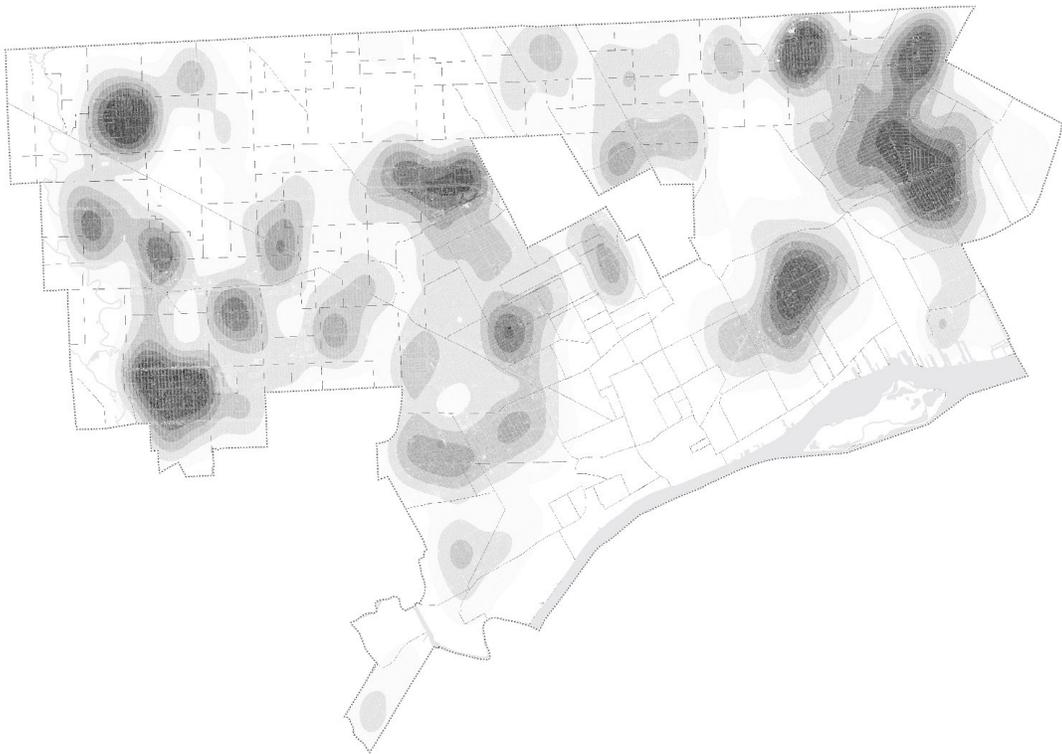
Original Woodward Plan, 1805

Detroit is the perfect locale for a speculative design on an Autonomous future of cities. The city envisioned two centuries ago by Augustus Woodward, its first master planner, as a city of abundant public place, boulevards and perfectly enclosed plazas has become an experiment in car oriented urbanism. The current decline of the city present an opportunity to envision the next step in the evolution of transport and urban space.



Realized Woodward Plan

Demolitions



Hard Hit Zones



Car Ownership

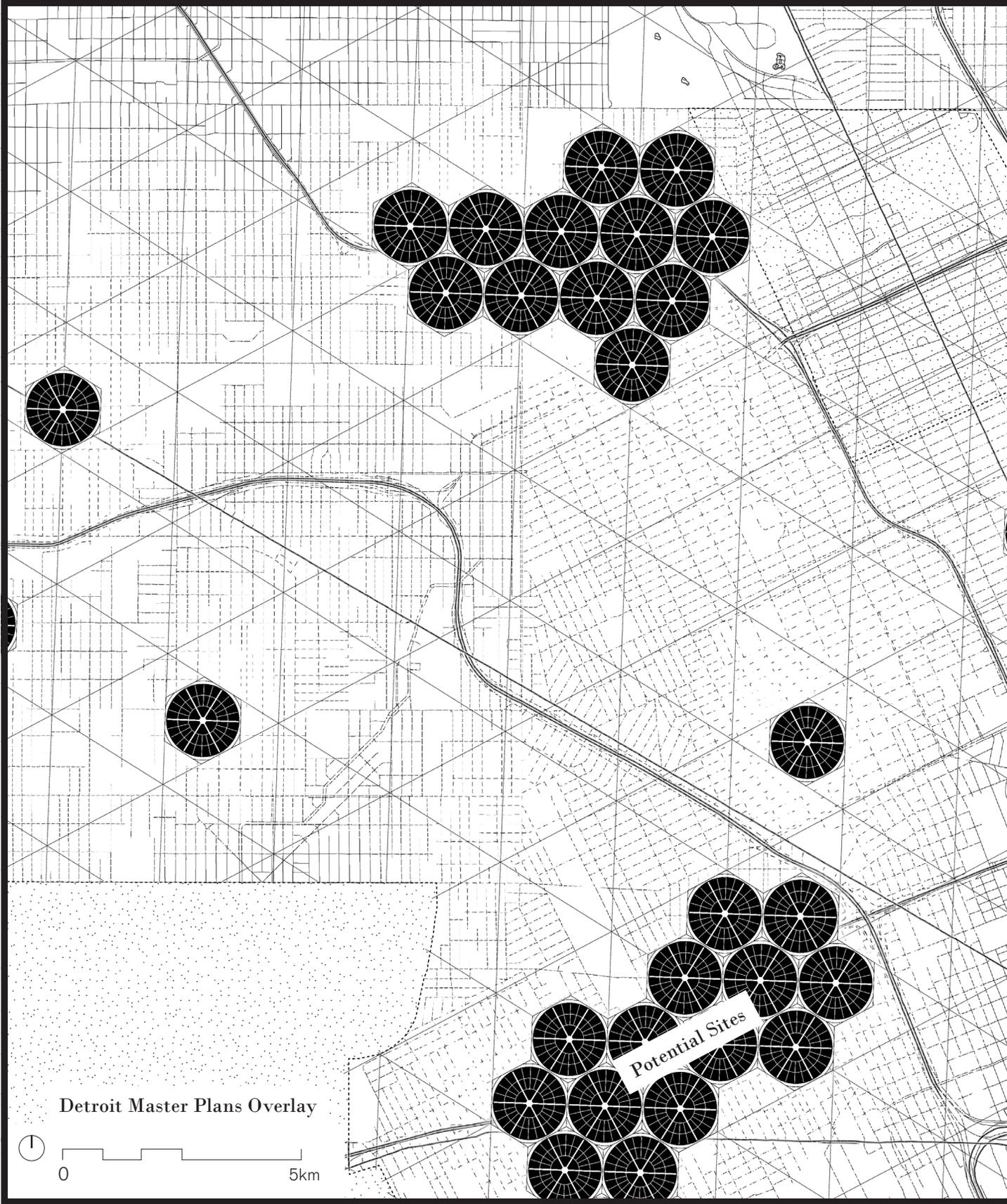


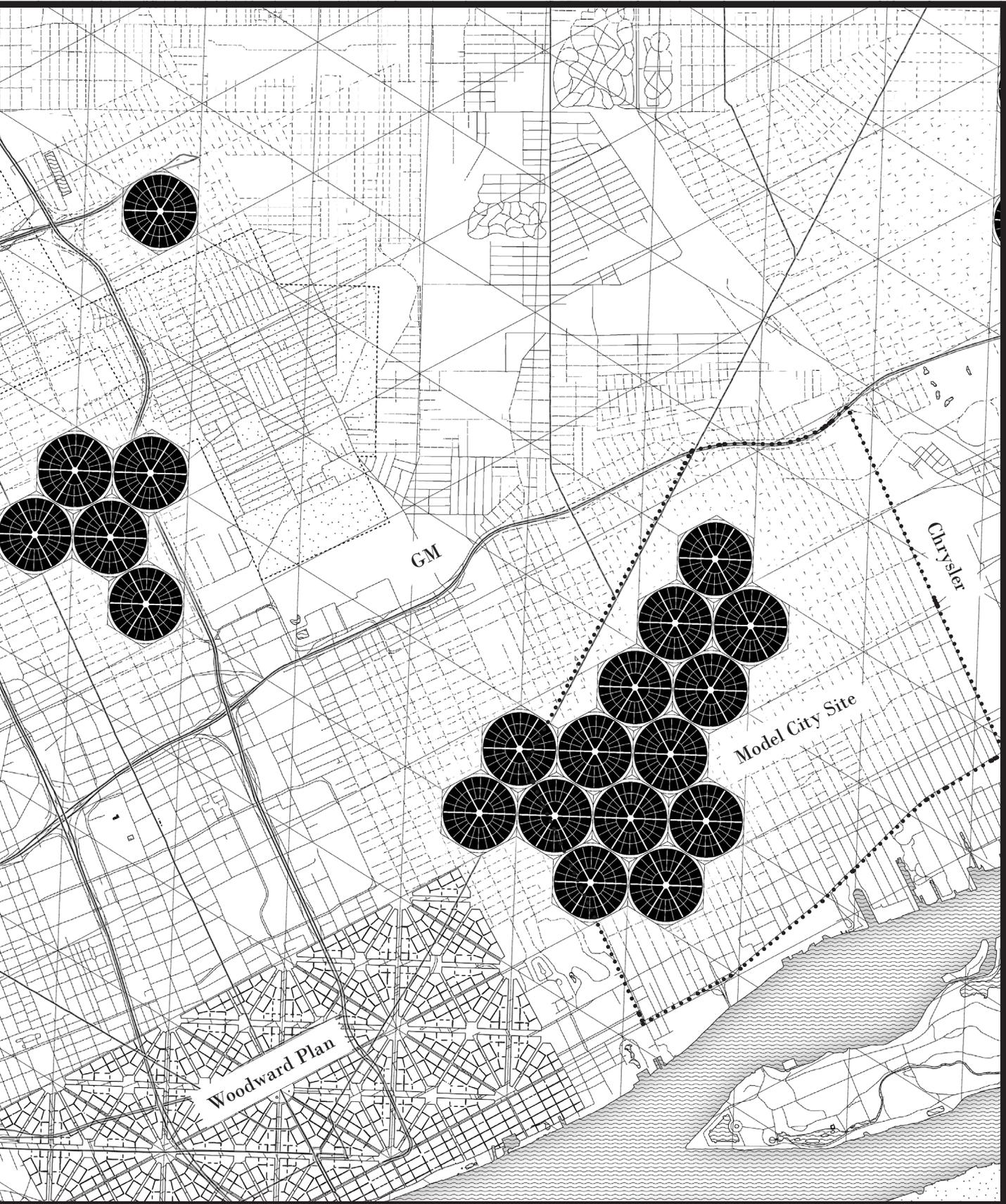
Density

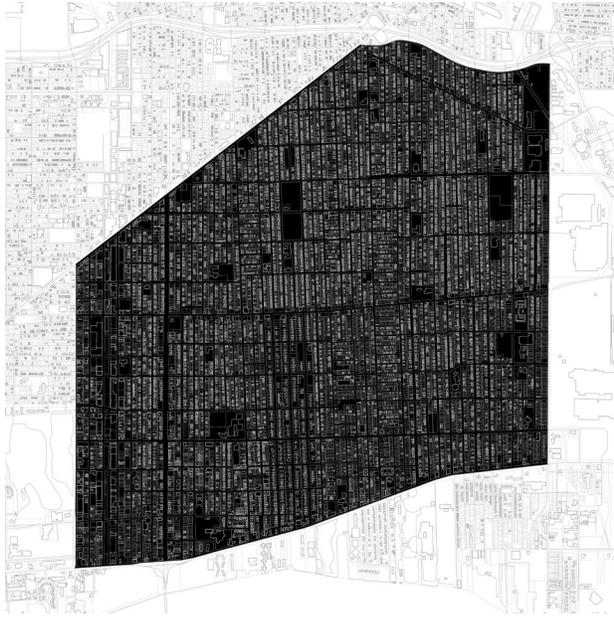


Parking Space

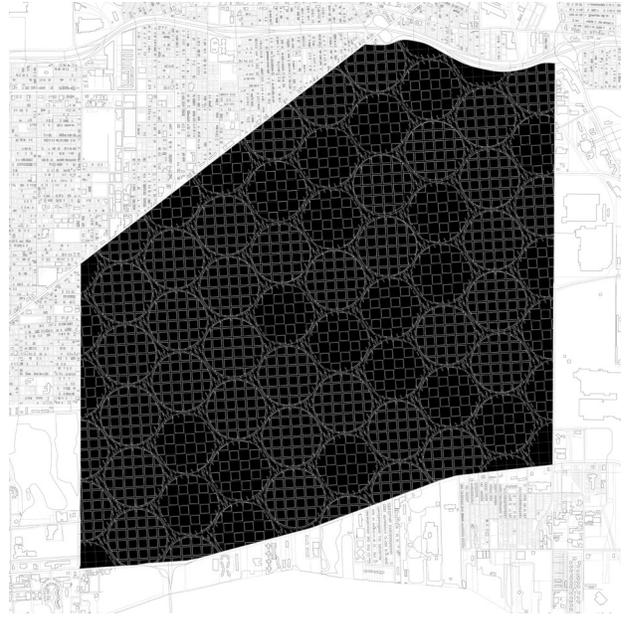




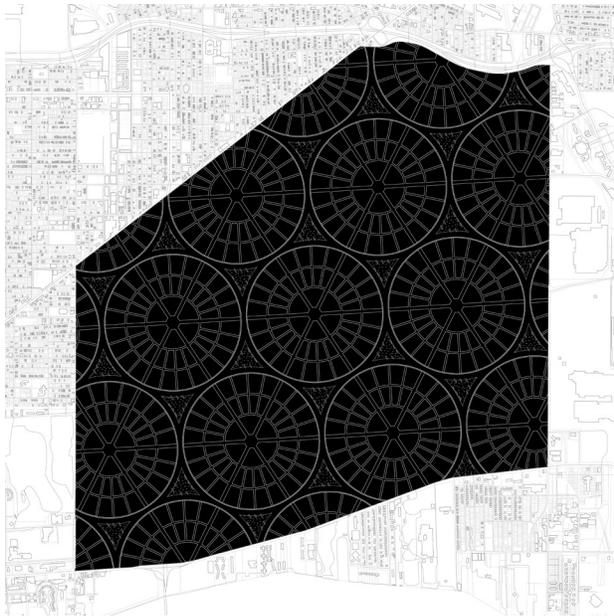




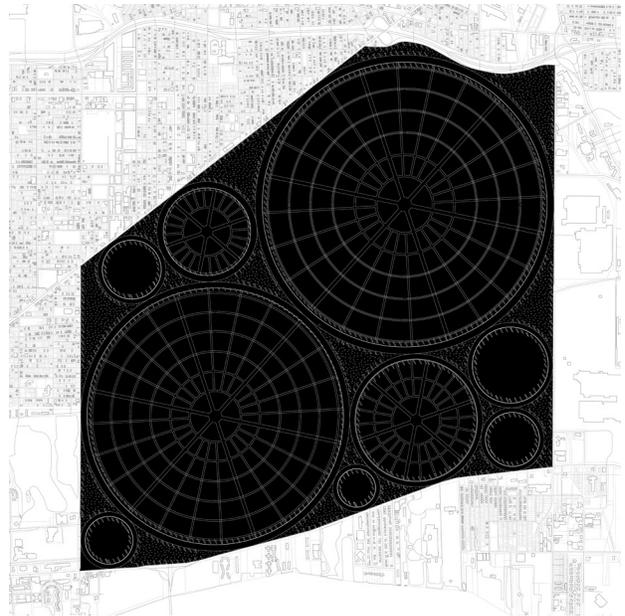
Current Condition



Superblock Model

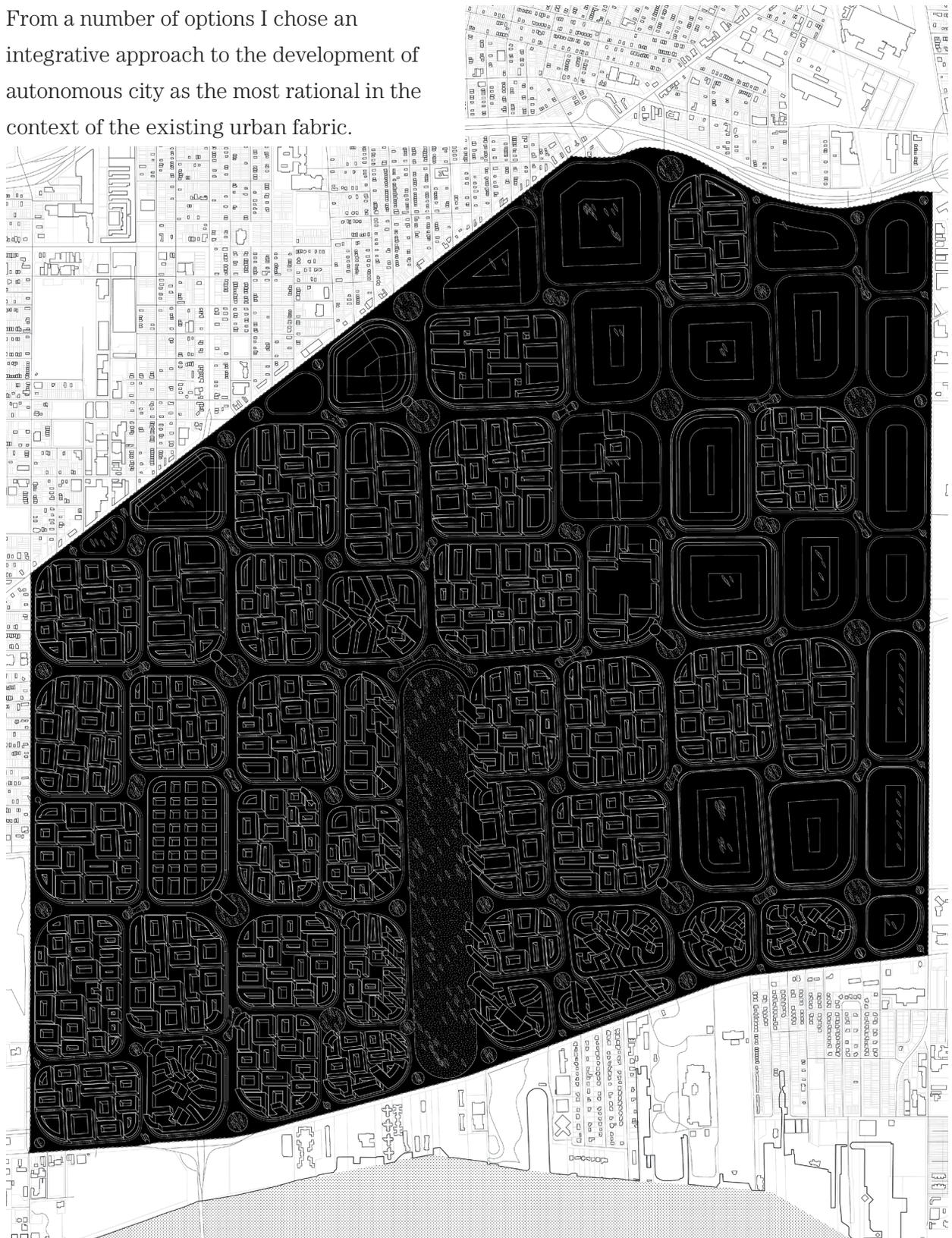


Walkable Neighborhood Model
(based on Woodward Plan)

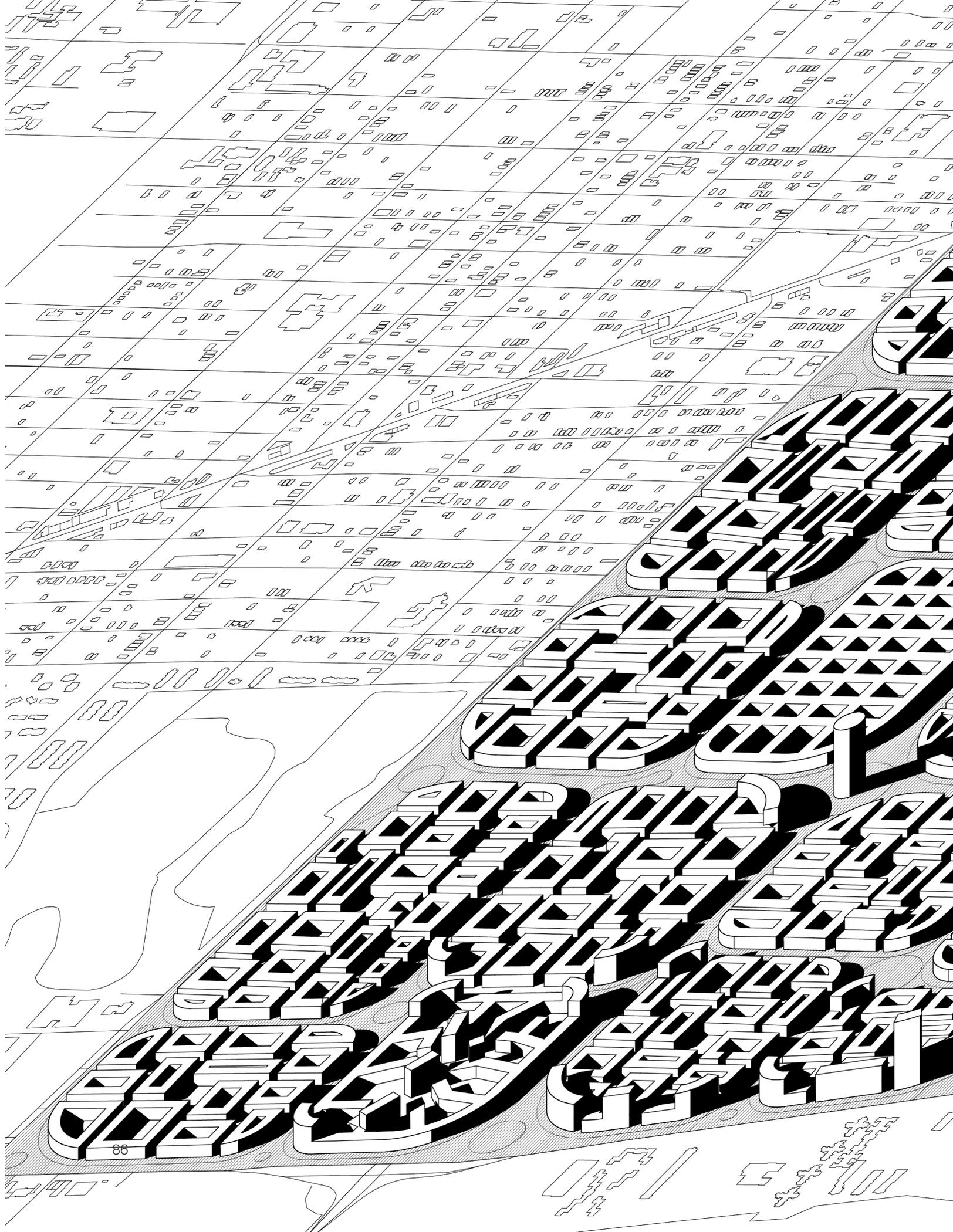


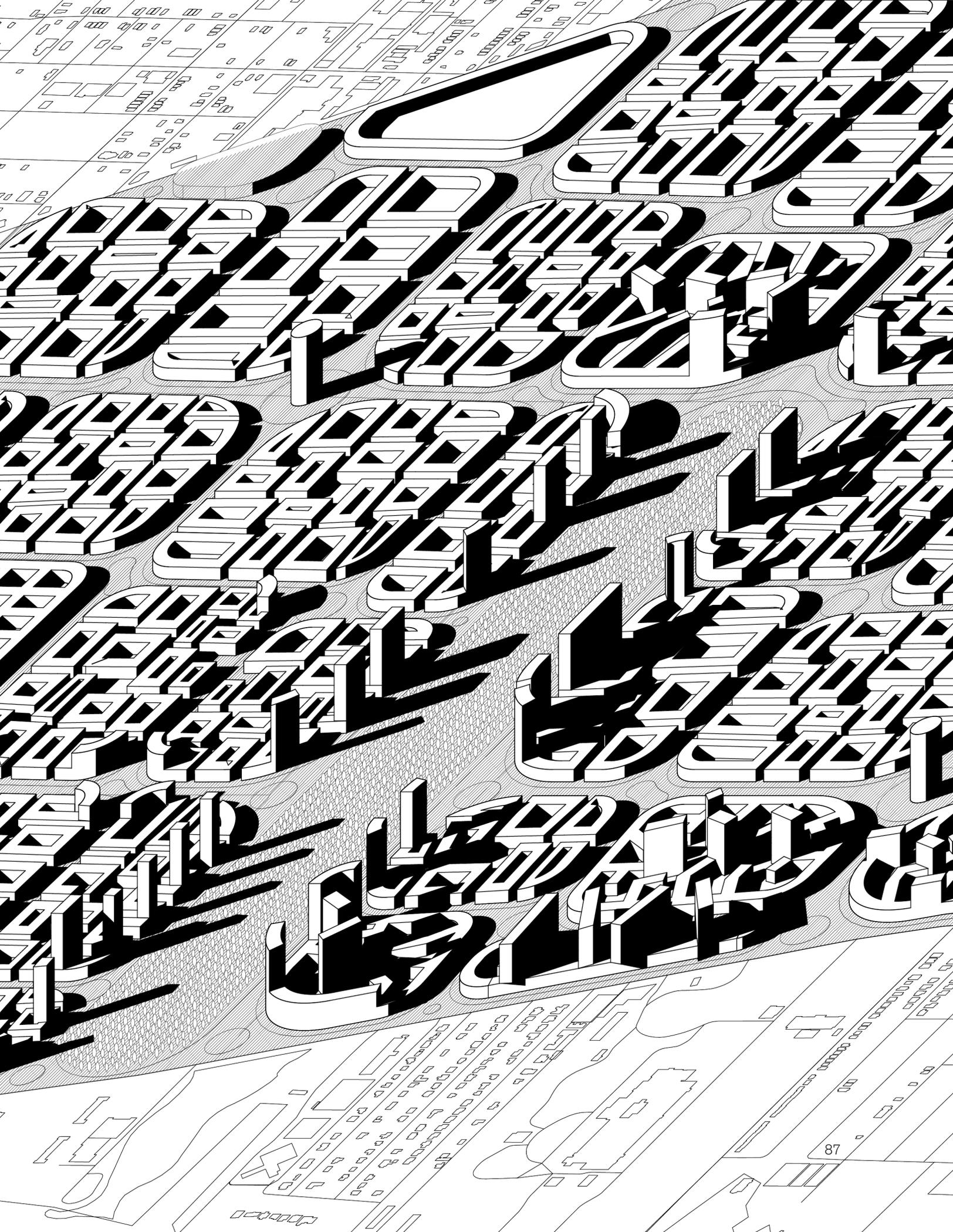
Walkable Town Model

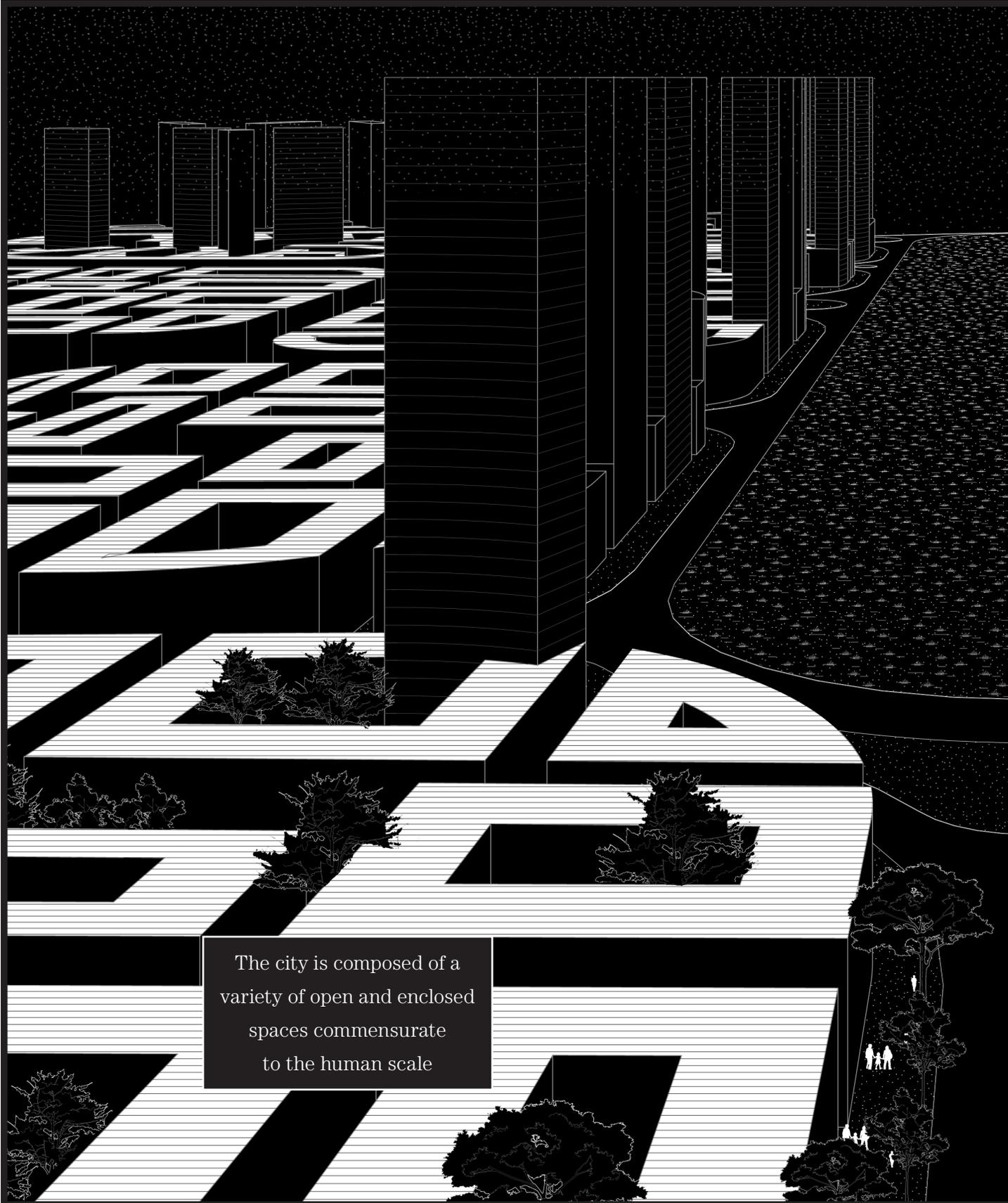
From a number of options I chose an integrative approach to the development of autonomous city as the most rational in the context of the existing urban fabric.



Integrated Model







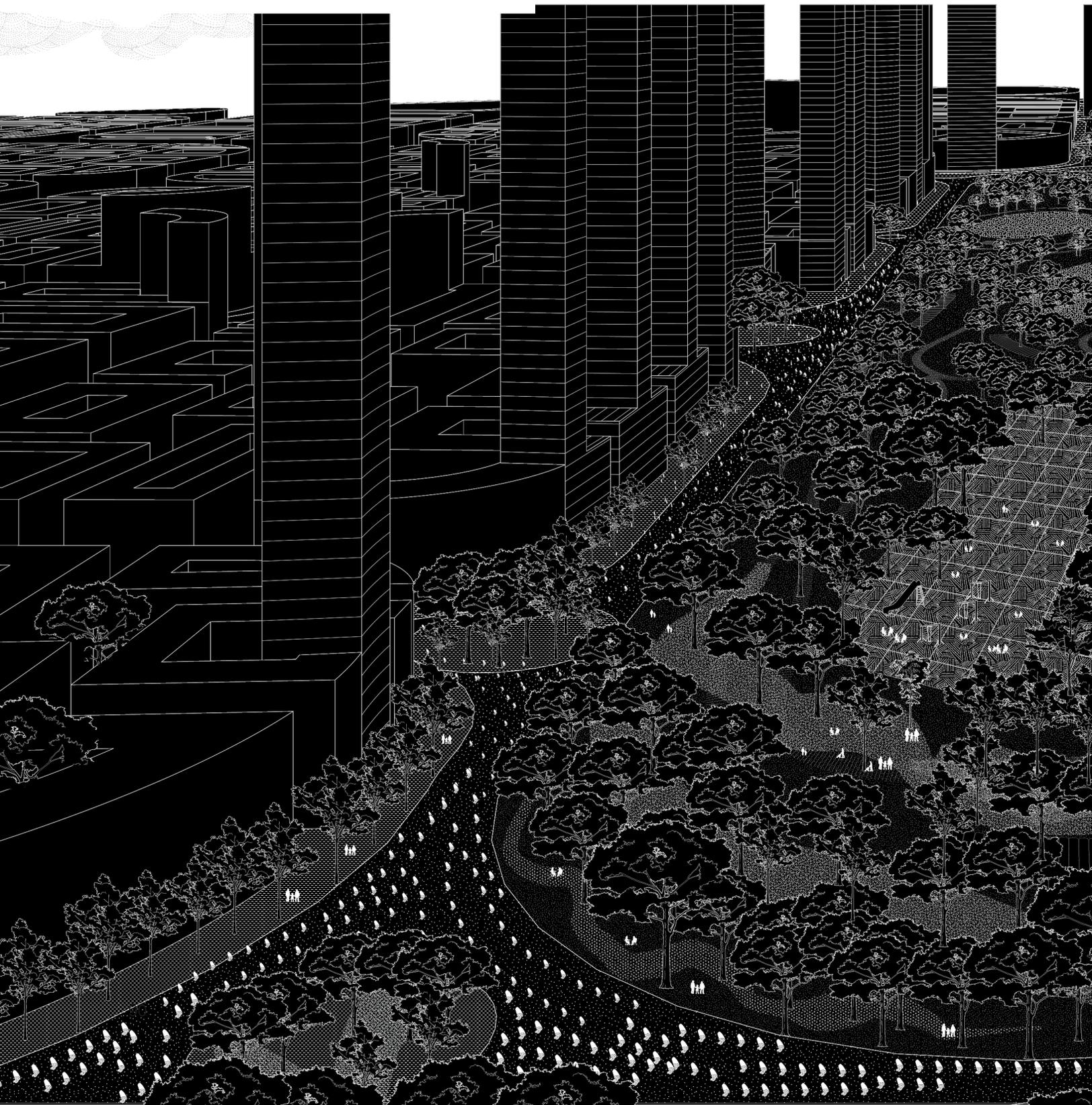
The city is composed of a variety of open and enclosed spaces commensurate to the human scale

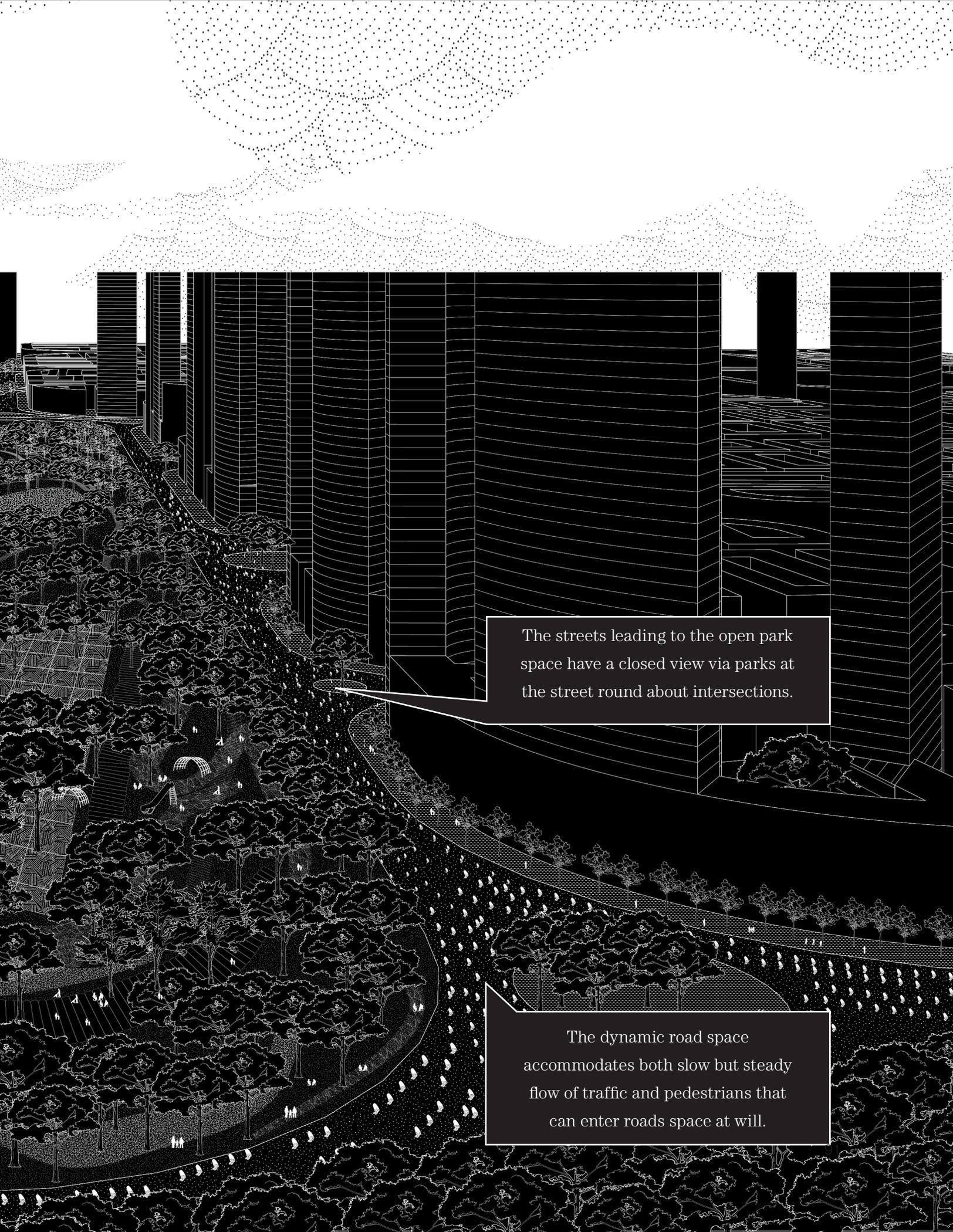


The residential areas do not exceed 5 story height, while taller buildings are strategically located in the visual stratum at the street intersections or adjacent to open space to the open space.

The drawing communicates the ideas expressed above, namely, separation of urban space vertically in active, social and visual strata.

Here tall buildings work spatially because they have sufficient spatial shadow in horizontal space of the park and define the space of the park well formally

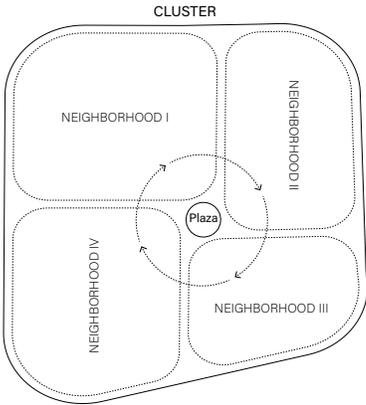




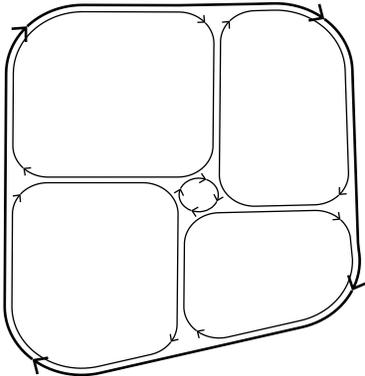
The streets leading to the open park space have a closed view via parks at the street round about intersections.

The dynamic road space accommodates both slow but steady flow of traffic and pedestrians that can enter roads space at will.

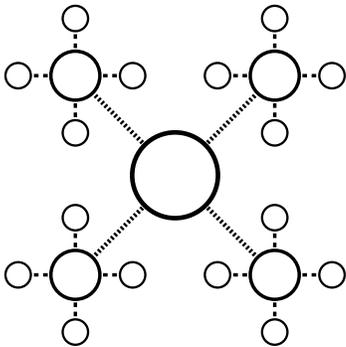
Neighborhood Cluster



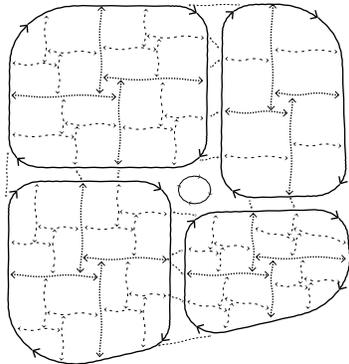
SPATIAL ORGANIZATION



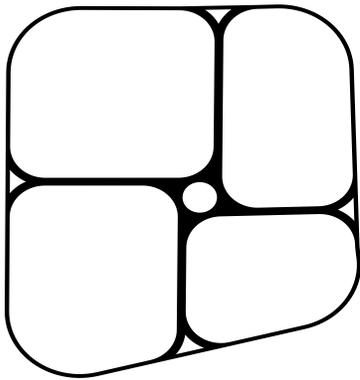
AV CIRCULATION



HIERARCHY OF PUBLIC SPACE



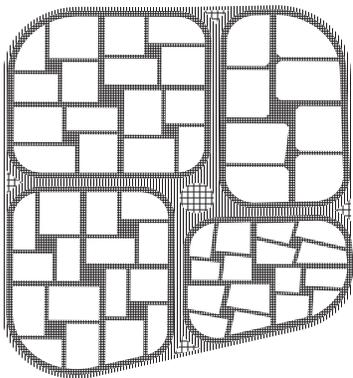
PEDESTRIAN CIRCULATION



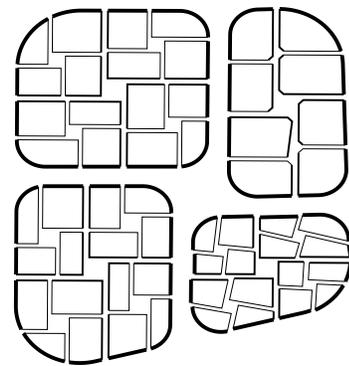
ROADS



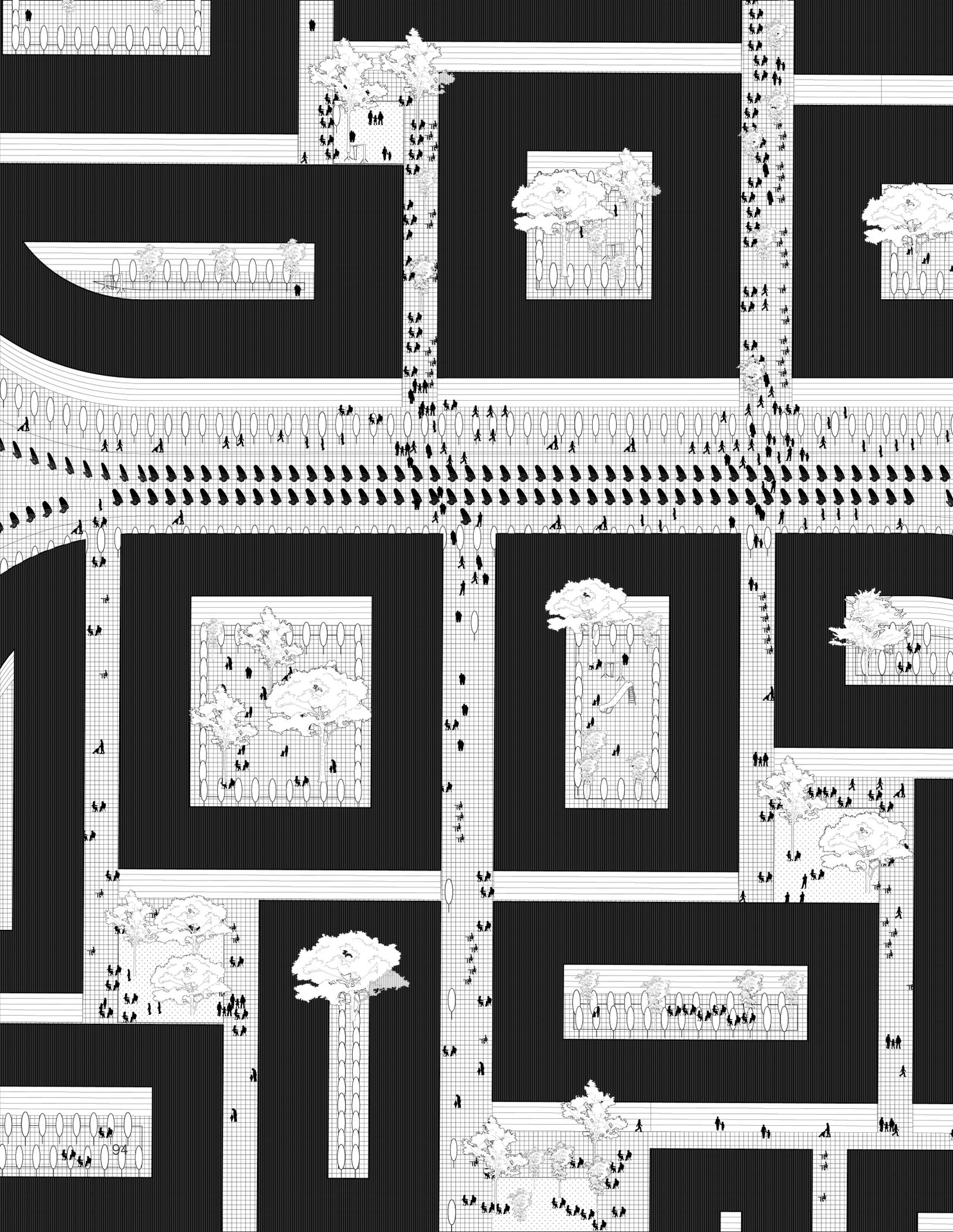
PRIVACY GRADIENT

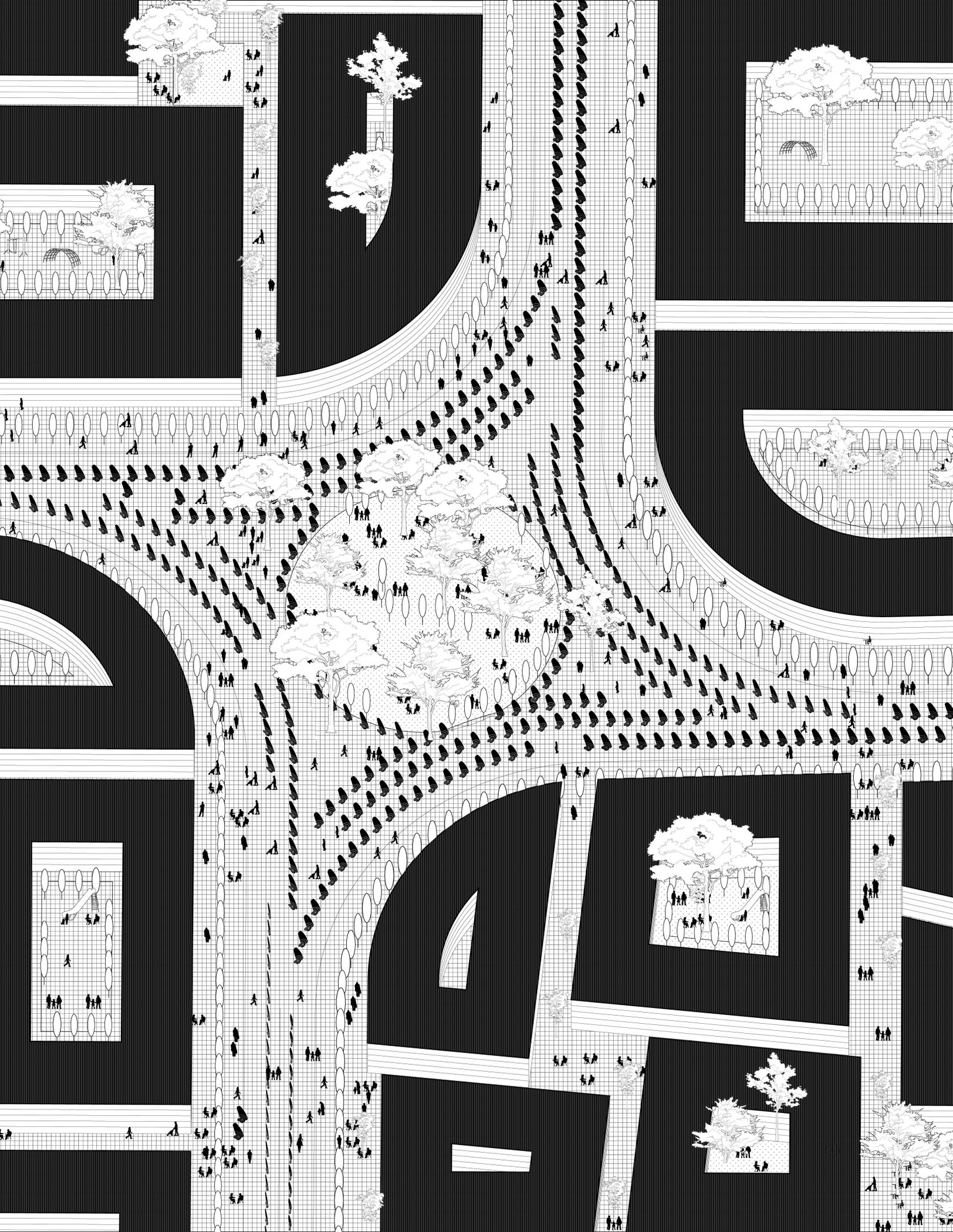


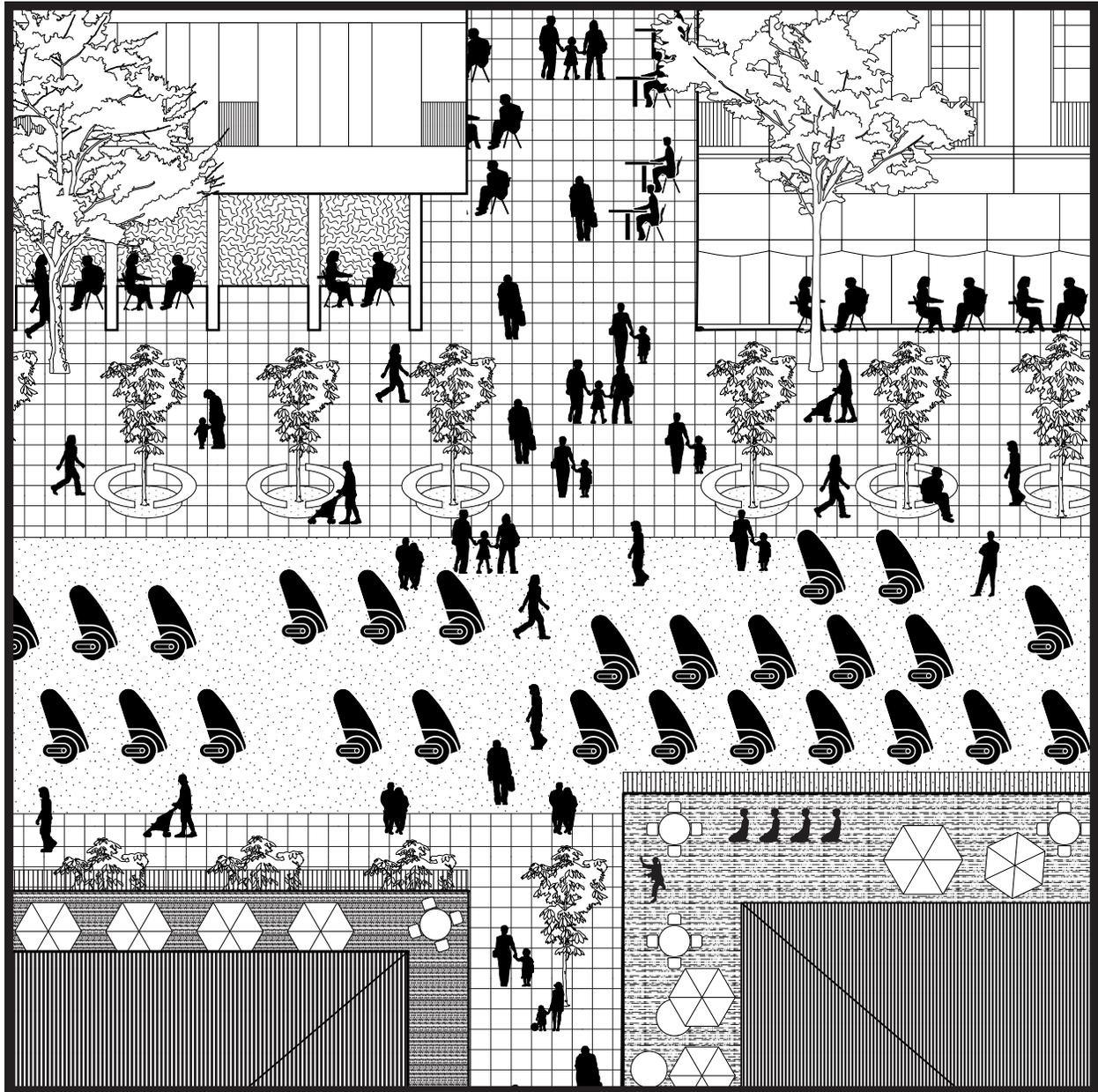
PUBLIC SPACE

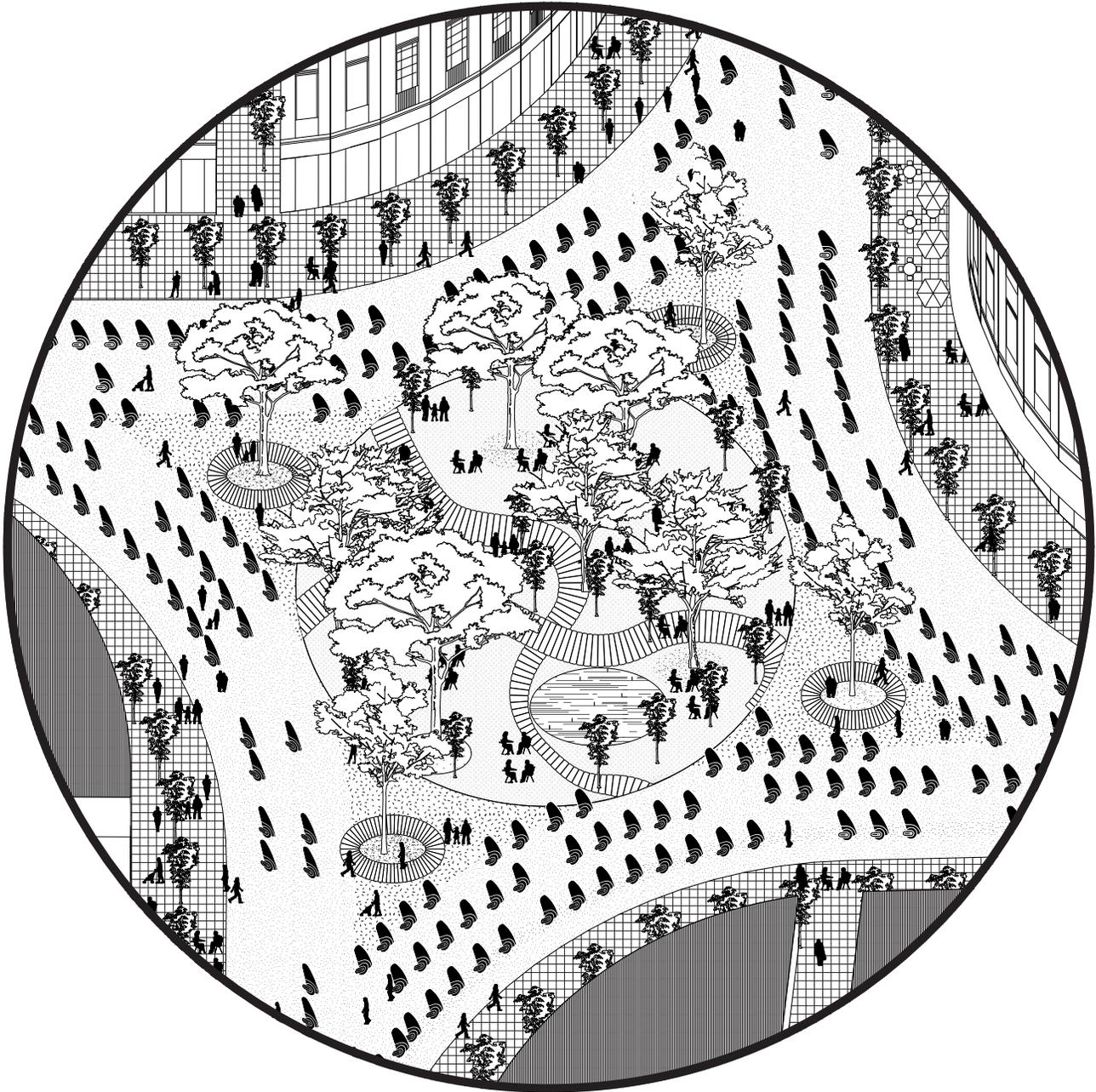


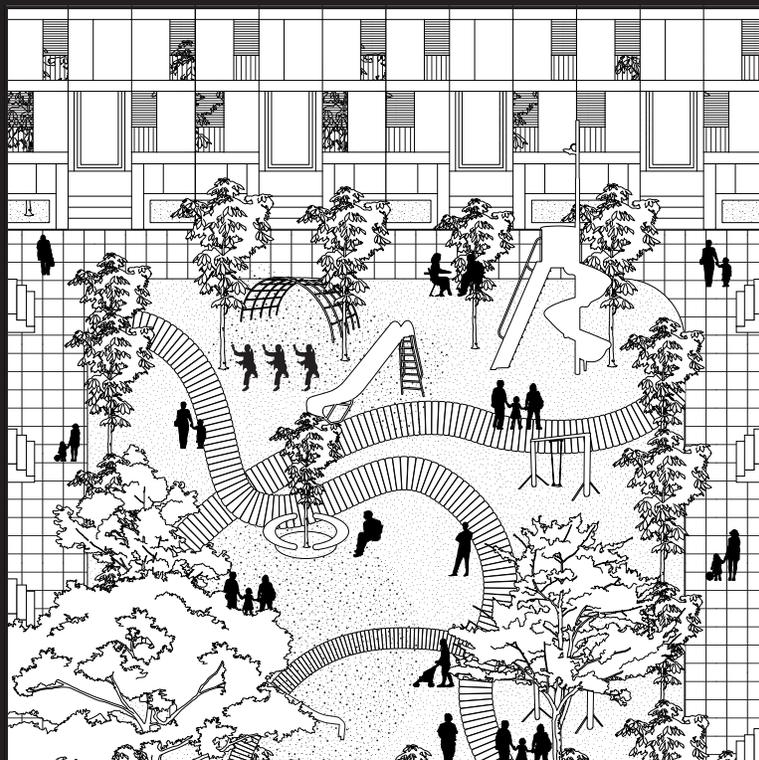
HIERARCHY OF STREET WALL

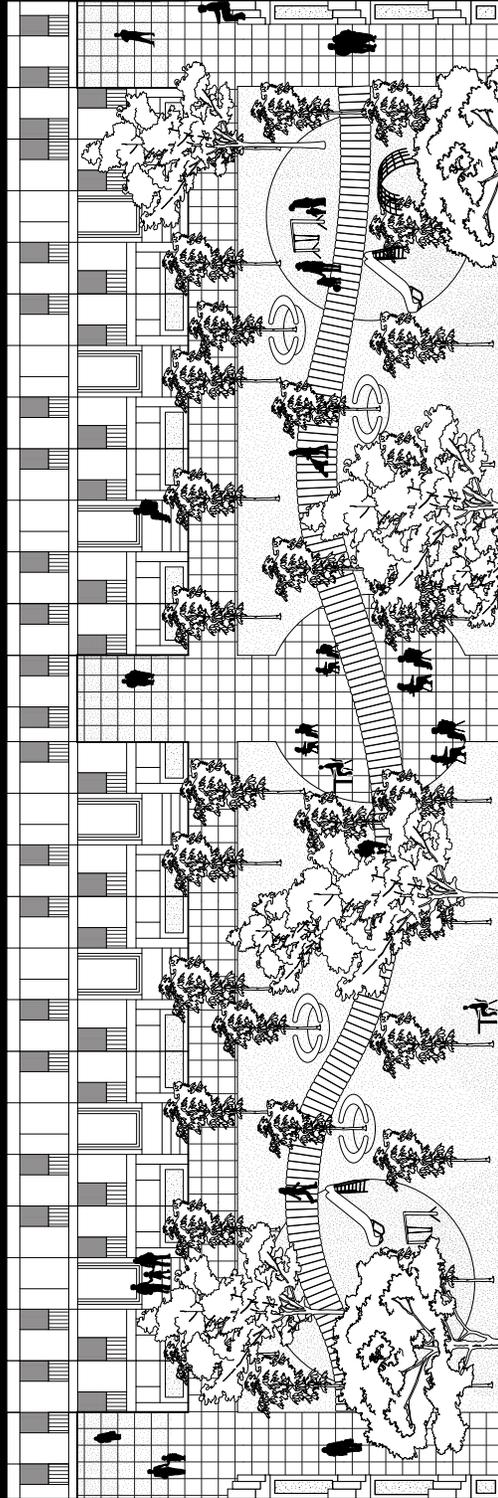


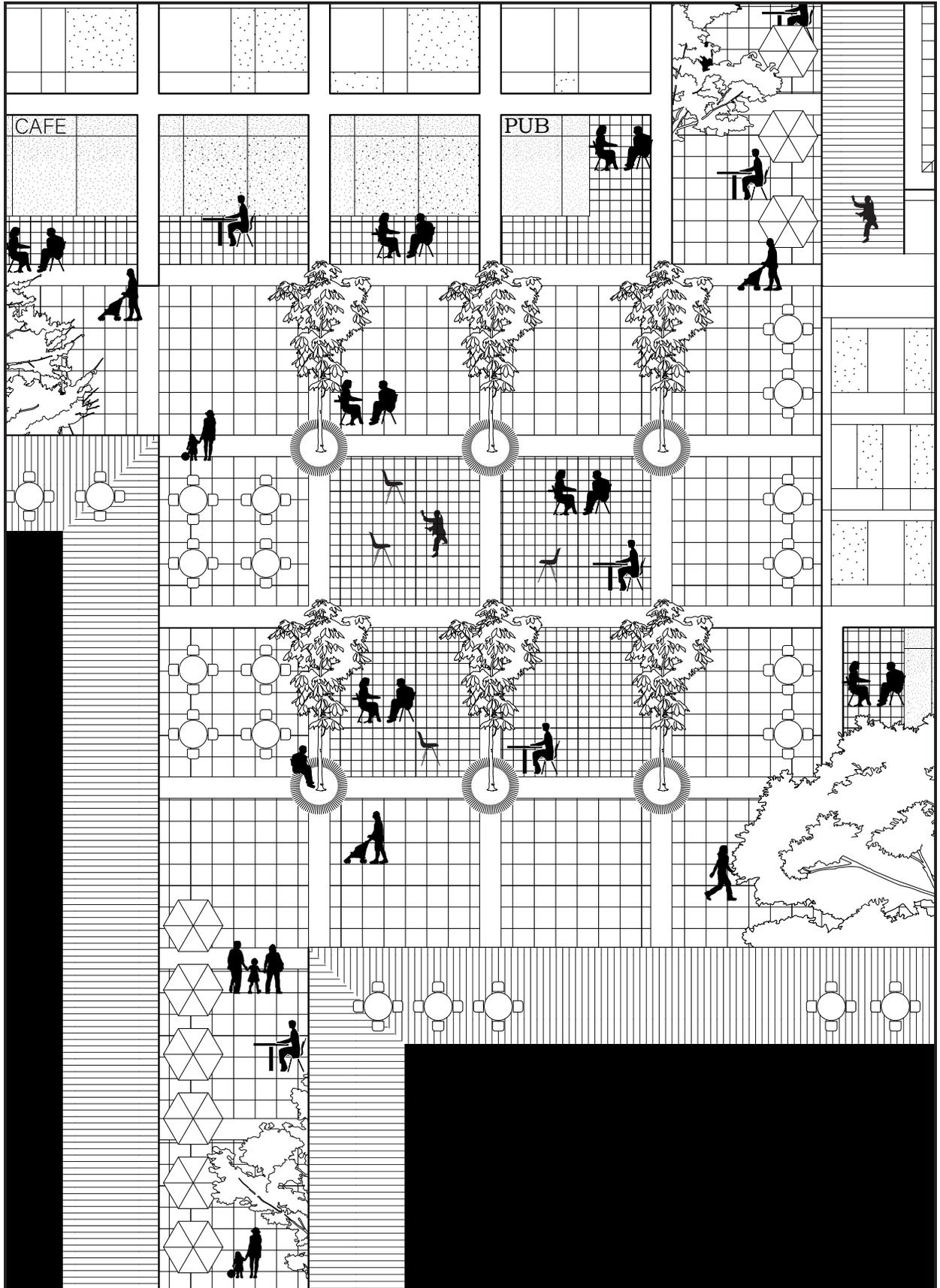


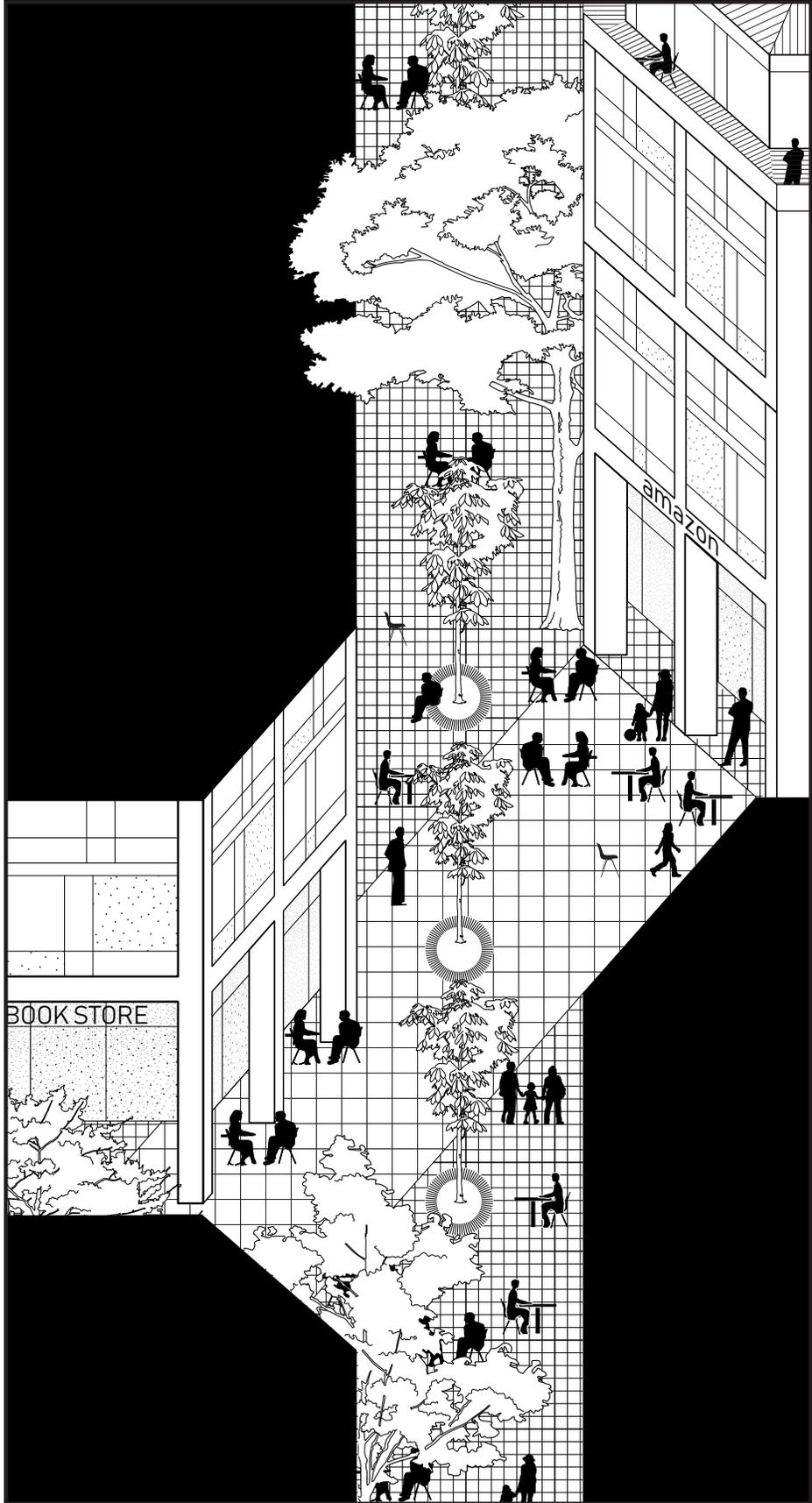


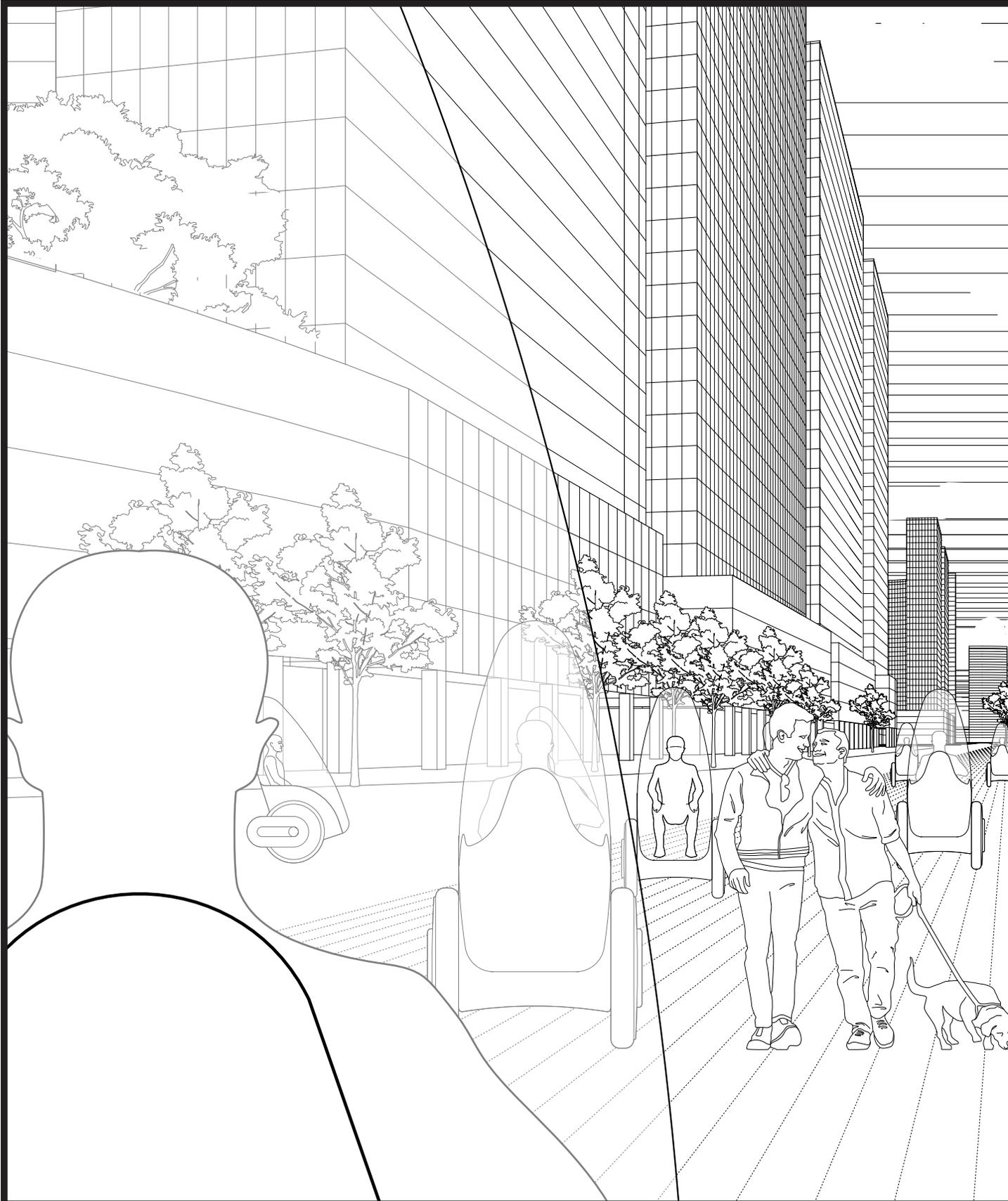


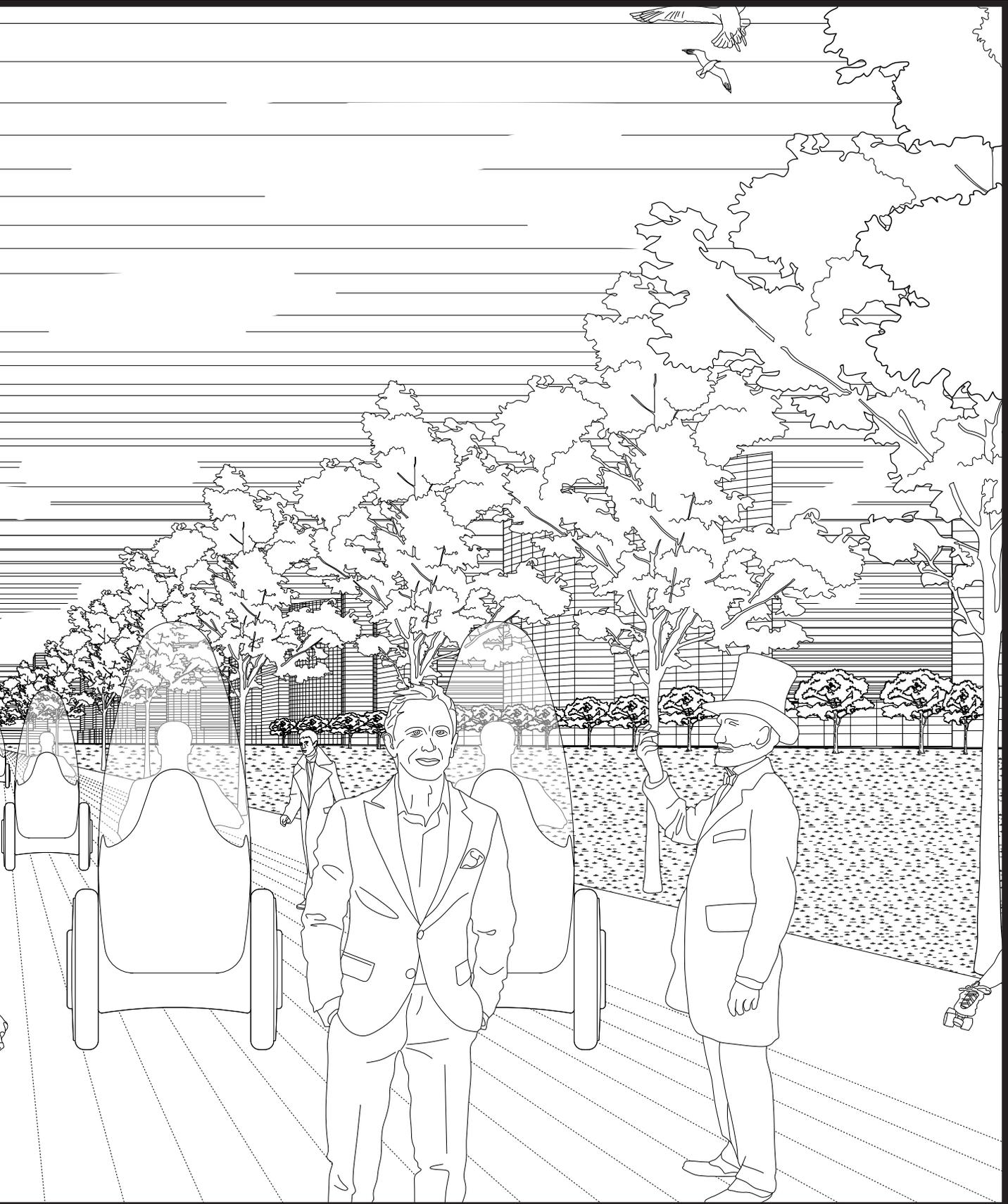












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