

# The neurospatial origins of urban real property

M. Gordon Brown

## Introduction

A review of the 1940 edition of *Land Economics* (Benedict 1940) says the field is difficult to define, has ramifications that are extremely far reaching and that the authors “put more emphasis on space relationships.”

In the late 70s I became interested in cognitive maps but, except for several years of university teaching, spent most of the next three decades analyzing public space, problem property – malls, retail streets and offices – along with appraising and doing vehicle and pedestrian counts and related analysis. Indirectly related were configurations of newer suburbs and traffic congestion. I saw there was a bigger picture here that was not in focus.

My book published last year, *Access, Property and American Urban Space*, aims to put this bigger picture into focus. *Access* is about changed conditions allowing movement between streets and adjacent real estate, the way it is used in *eminent domain* takings, and to the way streets and street systems regulate traffic movement, a function of the *police power*. *Access* is also the mechanism enabling us to connect with resources we don’t own. The book examines these changed conditions from a perspective that links cognitive mapping and related neurological research with historic and prehistoric urban spatial configurations.

While almost all new American settlements since 1800 had grid-form street systems, it became almost impossible to find extensive grid-form street systems in developments from the 1960s on. In the 1970s, annual economic productivity increases and new firm starts dropped by 35 percent and household debt increased 35 percent. The book proposes the key intervening variable between street form and productivity is *spatial transactions costs*.

Almost all settlements worldwide, from small villages to large cities, are characterized by grid-form street patterns. Many were offset, fragmented and incomplete; none were perfect grids, but they were everywhere.

## Space

It’s taken a long time to understand space we inhabit. In Homeric Greece, *Ouranos* was space: the sky and the heavens. The earth, *Gaia*, was his consort. See figure 2. A few centuries later some philosophers realized it was more complicated. Aristotle said space is inseparable from the matter contained in it. But soon after Aristotle, Strato of Lampsacus said, “Some make space equal in extension to the cosmical body and declare it, though being void by its own nature, to be always filled with bodies and only theoretically to be considered as existing by itself.” This is *absolute space*.



Figure 1. Ouranos, space, Gaia, earth and their children.

Around the same time, Theophrastus said, “Perhaps space is not a reality by itself but is defined by position and order of the bodies according to their natures and faculties, as is the case with animals and plants and all non-homogeneous bodies ... [that] have the nature of a structure.” This is *relative space*.

Architecture and real estate require two different conceptions of, or ways of thinking about, space. Space in architecture is mostly geometric, three dimensional, existential and relative. Space in real estate is mostly geographic, two dimensional and absolute. As such, architectural (and its relatives like urban design) is about the organization of *relative space* using visual and graphic representations, whereas real estate is about organization in *absolute*

space using verbal and quantitative representations. Planning sometimes uses space in one, the other or both ways.

## Facts

Real property is often confused with real estate. Brits and others call real estate property but even though they're related there's an important difference.

The distinction can be seen as two sides of a coin as shown in figure 1. *Real estate* is about *brute facts*, the *spatial-materiality* of buildings, improvements and the land they occupy. *Real property* refers to *institutional facts*, the abstract financial, legal, agency and other conditions and rights inherent in the *ownership* of land and buildings. The institutional fact of real property is an overlay on the brute fact of real estate in the way that the institutional fact of Canada overlays the brute fact of the north portion of the North American continent.

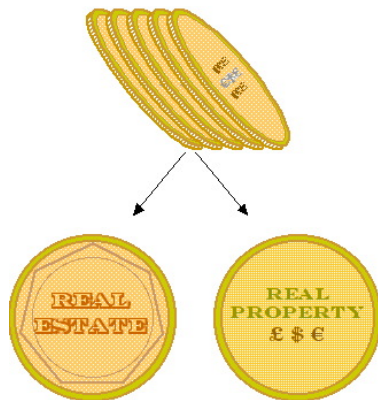


Figure 2. Real estate and real property as two sides of a coin.

The immobile space of real estate existed long before real property conventions enabled it to be bought and sold. It existed even before we realized that that the big nothingness between all the material things we could see and touch as we went from place

The cellular character of public and private urban spatial configurations derives from relative space, space relative to our own being and interests but is owned and exchanged as though it's absolute space.

## Space and Property: Public and Private

We distinguish property and space as public and private, but the differences between them are not that

simple. Private property can be a public space (like many shopping malls) and public property can be private space (like an office in a government building). Black's Law Dictionary says

*A public place is a place to which the general public has a right to resort; not necessarily a place devoted solely to the uses of the public, but a place ...visited by many persons and usually accessible to the neighboring public. ... Any place so situated that what passes there can be seen by any considerable number of persons, if they happen to look.*

If you walked in the large arrow's direction and looked in the smaller arrows' direction in figure 3, the degrees of publicness would be apparent.

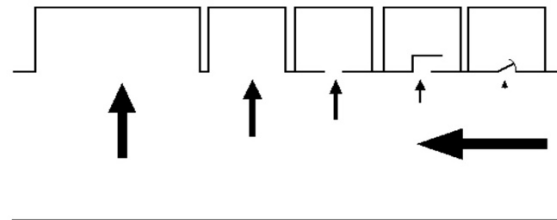


Figure 3. Five degrees of space from completely private to completely public.

## How We Made Space and Property: Phase 1

The cognitive scientist Steven Pinker says we are adapted to two habitats. Our first choice, the East African savanna, is where most of our evolution occurred. Because we survived in savannas, landscapes like savannas have features that are aesthetically appealing to humankind. Appleton's prospect-refuge theory explains why.

*... at both human and sub-human level the ability to see and the ability to hide are both important in calculating a creature's survival prospects . . . . Where he has an unimpeded opportunity to see we can call it a prospect. Where he has an opportunity to hide, a refuge. . . . To this . . . aesthetic hypothesis we can apply the name prospect-refuge theory.*

Prospect is what you see looking ahead, especially as you move forward; refuge is a possible hiding place along this route. See figure 4.

Developing humans were nomads for over 5 million years. We became fully human nomads at least 50,000 years ago. Nomads live in temporary or

conditional settlements. Then and now, nomads settle in small groups, blood-related families.

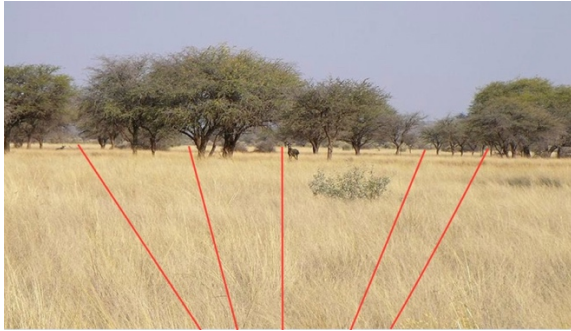


Figure 4. Lines of prospect in a savanna.

In nomadic communities governance and property were usually communal. Dwellings were/are typically round. Settlement borders/barriers were/are curvilinear. These pre-urban settlements provided refuge but not prospect. Refuge is within the walls but prospect is only outside the walls. There are no streets or real property. See figure 5. It was 40,000 years before these fully human nomads started building permanent settlements. We have lived in permanent settlements barely 10,000 years, less than one-fifth of the time we've been authentically human.



Figure 5. The shape of a nomadic settlement: Ovambo kraal in Namibia.

Early permanent settlements were built in conjunction with early agriculture beginning in the ninth millennium BCE. Like temporary or conditional nomadic ones, early permanent settlements offered refuge but no prospect. See figure 6 left. Settlement populations over five millennia increased up to several thousand and most were related through tribes or clans. Dwellings and settlement borders were roughly rectilinear and refuge was inside dwellings and walls. There were a

few courtyards but no streets. Entry was often through a roof hatch as in Çatal Huyuk. Ladders were essential. But prospect was only outside the walls or atop taller buildings or those coincident with walls. There was personal property but beyond the dwelling real property was communal.



Figure 6. Left: Haçilar, 8,000 BCE, < 500 people. Right: Çatal Huyuk, 6,000 BCE, > 5000 people.

## How We Made Space and Property: Phase 2

As trading increased after the agricultural revolution, more strangers came to settlements but were rarely admitted. Strangers, unrelated to anyone in the settlement, were not trusted. Most exchange took place just inside or outside the walls. This continued into early Rome. Over the next three to four millennia, more wealth brought more trading settlements. But desirable goods could bring trouble: settlements would be attacked, sometimes burned and rebuilt. And even large permanent settlements like Çatal Huyuk in SE Turkey could no longer accommodate the increased movement of occupants and outsiders who came to buy and sell. Communal governance was ineffective and strong leaders were needed. Major changes were necessary.

During the fourth millennium BCE, governance shifted from communal to leaders and a priesthood. Property ownership shifted from communal to private (family ownership) and collective, that owned by the state (the space not part of dwellings). Street systems were created for the first time as spaces for prospect were brought into the city. Dwellings provide refuge along orthogonally arranged streets. See figure 8.

The first authentic cities were developed in Sumer about 3000 BCE. Uruk was by far the largest settlement in the Fertile Crescent with a population of about 50,000. Figure 7. Exterior barrier walls are rectilinear and curvilinear; dwellings are rectilinear and no longer part of barrier walls. The sacred district



has rectilinear buildings and its barrier wall is rectilinear.

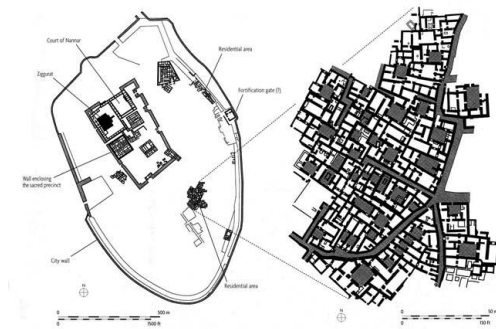


Figure 7. Ur and an enlarged portion.



Figure 8. A street in excavated Ur.

It is in the relationship between prospect and refuge that the relationship of public collective and private real property has its origins.

Our second choice of habitats is cities. Why else would today's massive urbanization and more people moving to cities happen? What happened in the Fertile Crescent was what's called biologically or genetically prepared learning. The prospect-refuge hypothesis proposes that the human visual system evolved to yield information about the utility of spatial-material surroundings with respect to fight-or-flight conditions in the search for resources. It's not that different in cities.

As we evolved, the ability to recognize prospect and refuge reliably would require cognitive mapping and

make it part of our neurological structure. Cognitive scientists Edvard Moser and May-Britt Moser and John O'Keefe received Nobel Prizes in 2014 for their research on the neural elements of cognitive mapping. O'Keefe showed a hexagonal grid in the hippocampal region kept track of an animal's movement. The Mosers showed that 1) when a land animal faces a certain direction, regardless of its position, *head direction* cells fire, and 2) when an animal is near a wall or an edge, *border cells* fire. *Head direction cells* are about knowing prospect. *Border cells* are about knowing refuge.

As a result of the spatial strategies we developed to survive evolution and were neurologically embedded, and after 5000 years of trial and error learning, we built human settlements so their spatial form replicated the the key elements of the space of savannas in which we evolved. From the earliest true cities in the Fertile Crescent to today, 1) buildings, which afford refuge, occupy positions that afforded refuge millions of years ago, and 2) streets, which afford prospect, occupy positions that afforded prospect millions of years ago. The result is that *prospect* generated public or collective property and *refuge* private property.

## Conclusion

It should be no surprise that two of the most economically dynamic cities of their day, Amsterdam and New York, have strong grid patterns.

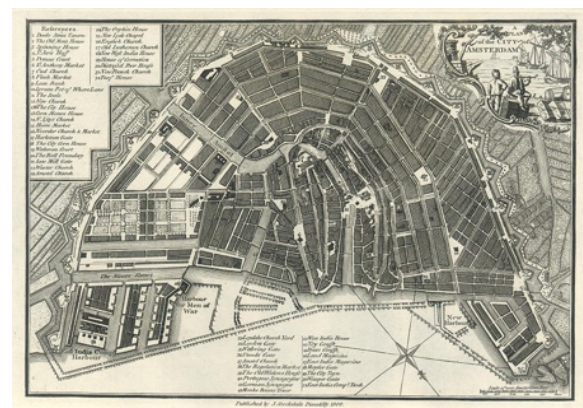


Figure 9. Radial grid – Amsterdam.

Prospect and refuge arranged into grid-form arrangements permit greater choice and distribution of movement. Grid-form street patterns are easy to scale thus enabling economies of scale. Movement in

grid-form street systems has a natural logic with low cognitive load. From a land economics perspective, they minimize spatial transaction costs.

A grid-form street system can be bent, overlaid with radiating streets, pocked with parks, and threaded by curving grand boulevards. They require little reliance on geolocation technologies. Grid-form street systems, in contrast with curvilinear-dendritic systems developed after WWII, enable what Gigerenzer (2000) calls fast and frugal heuristics: “little trade-off between being fast and frugal and being accurate.” They also inhibit paternalism and rent-seeking in location selection. Because they are simple, enable density and route choice, and generate face-to-face potentials, grid-form street systems function as general purpose technologies (GPT) enabling economic growth.

Grid-form settlement patterns can’t resolve every social ill in cities. But they have been thoughtlessly disparaged by designers and critics including the renowned Lewis Mumford, the urban historian John Reys and many others.

American urban development over the past five decades has, through a combination of moral design and industrialized finance, eroded the resilient efficacies of urban form it developed over many decades. Current efforts to create smart cities are not without merit, but smart cities need smart urban form.

Because they lived in a colonial setting, many of the Founding Fathers were familiar with Greek and Roman colonies which were grid-form partly because they needed to support commerce. Founding Fathers as different as Thomas Jefferson and Gouverneur Morris clearly preferred grid systems.

A composition of public and private space and property, urban grid-form settlements evolved through a slow, trial and error, and anonymous design process taking over five millennia. They enhance choice and foster commerce. We have taken them for granted.

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Figure 10. Ultra grid – Manhattan.

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