

“Surveying was a kind of writing in the land”: the economics of land division as town planning

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Abstract:

This paper is about the economic role of the primeval layouts (plats) for a *new development area* as a conscious act of physical planning. It explains that these foundational layouts a town or country in the “new world” was traditionally the work of a surveyor, the impacts of which have been lasting. Typically following a grid iron pattern, with roots in ancient history, the layout of the surveyor may not look attractive. Yet, it has stood the test of time and continued to condition modern development. It serves two significant economic functions. First, it reduces several types of *transaction costs* namely those of competition for land, valuation, allocation, identification and subdivision of land as well as revising a layout. Second, it serves to achieve agglomeration, establish a proprietary and common setting; and provide vital information as different forms of public good.

1. Introduction

This short paper elucidates, as outputs of physical planning for a new development area without *prior de jure* property rights, the economic importance of consciously and rationally created and surveyed, foundational or primeval layouts in terms of *transaction costs* and *public goods*.

To set the scene for our discussion, it must be stressed that it was not the town planner or the urban designer (**Krieger 2009**) but someone like US President George Washington (**Spurr 1951**) or Thomas Jefferson (**Reps 1961**), surveyors, who was the forerunner of physical planners in the “new world”. Back in the early days, it was a surveyor using his technical skills, which included no formal training in urban design and construction, who prepared layouts for towns.

The rest of the paper is organized into six sections. Section 2 explains the role of the surveyors in physical planning by laying out towns and countries for new development areas, and connects the neglect of their contribution to the demise of top down interventionist planning. Sections 3 and 4 set, respectively, the proprietary and economic context for the economic inquiry in section 5 by showing that lot boundaries are the products, units, and parameters of formal physical planning. (Section 6 shows how resilient are land boundaries and 7 is the conclusion.)

2. Historical context: Surveyors and physical planning in land division

Few would argue that formal town planning is only “limited to”¹ dividing up and distributing land. Nonetheless, such land division (and subsequent “sub-division” or (in the United States) “platting” of land into “blocks, lots and streets”) and allocation are definitely planning in its classic sense. And they

¹ An expression used by **Alexander (1994)** rebuking Friedmann’s idea that “while planners plan, the world moves on, for the most part without regard to the plans so carefully drawn up and so quickly outdated (**Friedmann 1994: p.377**).

are so, as Sir Patrick Abercrombie (1933: p.26) pointed out, because purposeful human actions (**Pusic 1969**) are involved.

Contemporary discussion of “spontaneous” planning or order, encouraged by a libertarian or anti-authoritarian interpretation of the market, does not contradict but rather should engage with this basic and very primeval mode of intervention in physical reality. If planning as drawing lines on maps has symbolic, long-lasting and actual physical results “on the ground,” we can also see that distinct social, cultural and economic consequences can follow. For instance, the decision to locate a new town, port or city in a certain location, once made, may shape the development of that place for centuries: - determine, to use a now common distinction, what sort of place a given geographical space will become (**Withers 2009**)

Price (1995), Home (1997) and Darwin (2013) showed how in many English speaking countries, division of land for settlement was not done by the “town planner” as today but by the surveyor, often with a military background. One of the principal contributions of the surveyor to modern planning was, by “laying out a town” or a farming area, the introduction of a *foundational* layout to a new development area (**Price 1995, Home 1977, Lai and Davies 2017**). Not many of these surveyors are today remembered as surveyors but rather, as we shall see, in other capacities. In some younger, former colonial countries, like Australia, the surveyors² are better

² Still, traces of the surveyor’s town and country planning influence may be found in older planning articles (see for instance **Haverfield (1913), Bannister (1943), Taylor (1945), Jeans (1965), Stelter (1980), Bunker (1988)**) and heritage or historical research focusing on individual surveyors as a class of people, as illustrated in the works of **Bangs (1887), Hough (1895), Smith**

remembered, for example Ronald Alison McInnis, John Septimus Roe, Robert Hoddle and William Light (**Petrow 1997, Porter 2007, Jones 2010**).

An insight into the idea of the surveyor of old as town planner can be come upon by considering the idea of the urban designer in **Krieger (2009)**. Krieger understands urban design to be distinct from architecture, engineering or planning. He seeks to explain why many *de facto* urban or civic designers have not been called “urban designers” by pointing out that the term urban design is a new one. In Krieger’s view, *designing* a town is not the same as *planning* one. ~~The better view is that the job of *bona fide* town planning has passed from the surveyor to the town planner and thence to the urban designer: historically speaking, this has been an original broad scope activity evolving into the specialized elements implicit from the outset.~~

This neglect of the surveyor’s contribution as the town planner is perhaps due to three reasons. First, it may be thought to be no more than normal or natural because it might seem that what was needed was done: places for settlement were found, a settlement site was chosen, it was laid out by surveyors, forests were cleared, swamps drained and reclaimed, land parcels were allocated and occupied, people multiplied and life went on. After he finished his job with laying out the last sub-division, the surveyor largely dropped out of the picture.

(1908), Jordan (1909), Fox (1941), Young (1946), Reps (1961), Andrews (1985), Jeffress (1992), Porter (2007) and Keating (2009).

The second reason, a topic that deserves serious research, is as noted above, the professional division of labour. A division first between surveying and planning then between the latter and urban design.

The third reason has to do with *master planning* with its heyday in the post WW2 era. In a review of *The Profession of City Planning: Changes, Images and Challenges* (**Rodwin and Sanyal 2000 eds.**), **Hopkins (2001)** reduced its demise to one factor. “...comprehensive planning failed to sustain its claims in practice or intellectually...” (p.383). That comprehensive planning “fails” or rather does not always and everywhere succeed actually depends on the evaluation stance. That it was considered as doomed to fail is often due to its apparent similarity with planning under a centrally planned or Soviet type economy.

3. Lot boundaries there always are in any physical planning

The academic demise of master planning as a mode of formal planning by the state – understood under whatever definition – does not mean that physical planning is, in practice, no longer needed. Physical planning is not necessarily the top-down, “rational and comprehensive” interventionist master planning imagined or imposed by government planners through edict that supersedes the invisible hand of the free land market. To think that way is to subscribe to a simplistic and largely erroneous plan-market dichotomy. Any government plan can be implemented by contract and not necessarily by edict (**Lai 1996, 1997; Webster and Lai 2003**). Furthermore, the land market cannot operate without a physical and spatial foundation that forms part of the private or communal land ownership structure. The ultimate provider and guarantor of that is inevitably the sovereign state. The private

sector cannot do this and should not do so in any instance, otherwise it would become the state *de facto*. The so-called classical example of “non-zoning” in Houston (**Siegan 1970**) can be shown to be one of “private zoning”, like that for Milwaukee, which is (**Beuscher 1958**) predicated on a state layout (**Lai 2016**).

However, boundary delineation, which is zoning in its generic sense (**Lai and Davies 2017**), is not the monopoly of the government in master planning. It is an essential dimension of real property and thus of the establishment of exclusive property rights systems for land resources. Hence, it is worth discussing in depth the role of boundaries in property rights by connecting town planning first to property rights, followed by property valuation, along the boundary front.

Property rights are not objects but *de jure* rules about access and entitlement to resources. All property rights regimes, whether common, communal, or private, have boundaries. The need for boundaries that define the geographical ambit of communal and private property rights, as exclusive rights systems, needs no elaboration. Resources under common property regimes (e.g. the high seas) are fringed by the *de jure* boundaries of resources encircled by exclusive rights regimes that govern most land surfaces and coastal zones of the world’s continents and islands.

To signal to strangers that there are restrictions on or conditions to access, holders of communal and private property rights use physical objects to define their *de jure* boundaries. Examples are “metes and bounds,” “stakes,” boundary stones/tablets, fences, walls, etc. In Asian farming

communities, as similarly in parts of Europe where both bunds and footpaths are so used, the field bunds used as communal passageways define individual privately-owned lots.

Land boundaries are highly important, as they define the location, shape, area, accessibility, neighbouring properties, and wider context of the property enclosed as a place. That place that is thus also the basic and therefore “natural” unit of town planning and development by private and public bodies. Therefore, land boundaries are necessary considerations for a valuer (an appraiser) when assessing the value of the property.

The delineation of private lot boundaries itself can be and was often an act of a government. As isolated pockets or part and parcel of a layout, delineation is an important process in the *initial allocation* of property rights by the state (**Home 1997**). “Allocation” is a term of art in economics and zoning. “Initial allocation” in this paper, to be distinguished from “subsequent reallocation” (**Lai 1996, 1997**) refers to the assignment of land rights from the state to the first owners. Sometimes these lots were granted by governments to squatters, economically powerful or poor (**Lai 2015b**), who had occupied government land. These private lots can, in due course, be sub-divided into smaller lots or combined into larger land plots by their owners.

Such delineation, subdivision, and combination are important planning activities. Their outcome is to lay out the primeval land use, transport and environmental framework, which invariably has due regard for transportation and goes hand-in-hand with aligning public roads to define the frontages of

land parcels. The framework, whether physical or legal, may neglect pre-existing private or communal boundaries of indigenous peoples, which causes suffering and hardship for them.

This framework not only allocates the property rights in various forms to public and private landowners, but also sets conditions on their use of their land. The adopted form of the framework has important effects different from its alternatives. For instance, a grid pattern of roads varies considerably from a cul-de-sac or blind alley pattern in terms of permeability and route choice, hierarchical ordering, flexibility, and readiness for the subdivision and recombination of lots.

As time goes by, modern transport developments and land use zoning backed by legislation may modify, complicate, and overshadow this framework, but will seldom eradicate it, as the transaction costs and social impacts involved in radically or significantly changing it through due process are simply too formidable. Looked at the other way, the framework can be seen as an implicit or explicit reducer of not only the initial transaction costs entailed in the distribution of land between particulars but, by its very existence as an informing framework, in any subsequent adjustments.

The newly-introduced zonal boundaries of the state in re-planning the town may or may not correspond to private property boundaries, in which case this discordance can create both opportunities and hardships for their users or owners. However, in most cases, such interventionist planning leads to planning blight for private properties, as reflected by a fall in property

values, urban dilapidation, and a failure to deliver the expected planning gains. (Lai et al 2007; Robick 2011; Lai et al. 2018a)

4. Theoretical background: space in economic and planning studies

To embark on our inquiry on the importance of property boundaries as products of *ex ante* government physical planning, there is a need to appreciate the landscape of economic and planning research on space.

4.1 Space and land boundaries in economics

Economists seem to have immense difficulties in dealing with *space*. They are not unaware of the importance of space as places, as reckoned for instance by Rosa (2006, p.210, italics authors’) in passing when he notes that “information must concern precise *places* and people as the decisions of each consumer reflect its particular needs and unique conditions.”

However, as Crevoisier (1999) explained, in land economics, space, meaning “place” or “location,” is abstract and not “real”. It is treated as either a point which has no area or a shape-free area without regard to its relationship with a layout or to the layout itself. In Pigovian economics, any line drawn on a map is treated conceptually in terms of two extremes. It is seen at one extreme as a permeable private front for discharging spillovers on neighbours or on public land in the case where the line is a lot boundary. It is seen at the other extreme as an impregnable public border against externalities in the case where it is an imposed zonal boundary.

Coasian economics, which regards government intervention in or court adjudication of land use conflicts as options part from private settlement deny

this polarised Pigovian non-interactive understanding (**Lai 1996, 1997, 2007**), treating the private front as a negotiable fence that can be moved forward or backward depending on the values of respective land use activities. To test the effectiveness of government zoning in statistical modelling, the zonal border line is again reduced to a point, or rather to a binary matter of zero or 1: whether it exists or not.

Neo-institutional economists **Libecap and Lueck (2009: p.1)** pointed out correctly that “the demarcation of land defines property boundaries and location and is a foundation for land use and markets” and that although “it seems self-evident that a system of demarcating rights to land will have long-term effects on land use and value, the literatures in economics and in law have not addressed these issues.” However, they proceeded to test and compare the effects of two major forms of land division of the USA, viz. metes and bounds and the rectangular system required by the US *Federal Land Ordinance* of 1785 (**Libecap and Lueck 2011**) instead of discussing the impact of demarcation *per se*.

Homesteading³ cum checkerboarding, which was adopted by the US to open up its western region and which we shall visit, was treated either as a land allocation method (**Allen 1991a**) or parameter (**Akee 2009**) rather than as a land allocation *pattern* (i.e., a spatial phenomenon). A homestead is a piece of land acquired from US government by an applicant under the Homestead Act of 1862. Checkerboarding refers to situation where land

³ **Gates (1936)** explained that homesteading happened in parallel with land sales and land grabs by white settlers. See, also, **Rosser (2012)**.

ownership is intermingled between two or more owners, often involving Native Americans.

Agglomeration economics is about cities, but there is apparently no work addressing the role of physical planning in enabling or constraining agglomeration of people in cities, not to mention the relevance of private property boundaries in them as a research topic. The only known neo-classical treatment of agglomeration is in terms of the concept of external economies of scale (**Rosenthal et al. 2004**), something that shifts a production function in which land or lot boundaries do *not* feature.

4.2 Space and lot boundaries in planning research

In the planning field, which is manifestly “spatial,” the concept of space has long attracted much lively debate. In a recent paper in a planning journal by **Cao and Zhang (2013)**, the distinction stressed by **Friedman (1994)** between the “Euclidean (mode) of planning and “non-Euclidean planning” was referred to in their excursus on the “space” distinction between “Euclidean space” and “non-Euclidean space” in planning terms. Unfortunately, the space distinction did not appear to address the differences between two modes of “planning” or the critique by **Alexander (1994)** of **Friedman (1994)**.

~~On a careful reading, “non-Euclidean planning” as understood by Alexander and Friedmann had nothing to do with non-Euclidean space as a mathematical notion and really means “extra”-Euclidean planning which, as Alexander explained, “is not limited to” planning based on Euclidean planning, which was described as “future-directed”.~~

The important work of **Mazza (2009)** focused on the political purpose and implications of the grid as a planned form, while our submission is about its economic rationale and effects. The discourse of **Mazza and Bianconi (2014)** on the substantive vs. process related knowledge in planning referred to the grid as a subject but did not see the layout, whether grid or otherwise, as a resource (property rights) allocation device. The interesting work of **Alexander et al. (2012)** wrestled with the same types of issues mentioning grids but did not deal with the economic nature of the grid or layout planning.

Australian economic researchers notably **Andersson et al. (2011)** and **Andersson (2012)** have a lot to say on space and planning, especially on urban innovations, something which articulates well with Coasian economics (**Lai 1996, 1997; ~~Lai and Lorne 2014~~**) applied to this inquiry. Both paradigms are highly skeptical of state interventionism in the market. While the former does not deal with innovations assuming the best technology, it does inform on the need in real world applications of its concepts for appropriate institutional arrangements like entitlements and IP protection for innovations.⁴ (**Lai and Lorne 2014**)

The next section will discuss something that has not been attempted in either the economic or planning arena: an interpretation of land division

⁴In a private interview between Ronald Coase and Lorne, the author and others in Chicago on 18 June 2013, less than 3 months before Coase passed away, Lorne asked what Coase had thought of the work of Joseph Schumpeter. Coase politely said, “He was upstairs, I was downstairs.” (**Lorne 2020 forthcoming**)

for development by the state in terms of two economic concepts, namely “transaction costs” and “public goods.” Transaction costs are costs other than those that are involved in the physical production of goods and services. Public goods and services that are jointly consumed, incur zero marginal cost in serving an extra consumer and are hard to price (**Lai, Davies and Lorne 2018b**).

5. Transaction costs and public goods aspects of formally planning a land division

It is submitted that an understanding of the value of laying out land as a matter of Euclidean space planning for a new development area in terms of a Coasian transaction costs perspective (**Coase 1937, 1960**) and as a public good is fruitful for better appreciating the planning, as well as the land economic issues involved. This is especially so because the layout embodies rules of governance for an area. This notion of property rights as public goods was further reinforced by **North and Thomas (1973)**, who studied the history of the “rise” of the Western world.

There are specific transaction costs incurred in and saved by planning as land division and subdivision. Such an understanding should supplement the traditional transaction cost approach to modern planning, with its almost exclusive focus on grounds for or against interventionist *zoning* (see for instance **Karkkainen 1994**), presumed to be under legislation, (see for instance **Bettman 1924**) against externalities and on the provision of public goods. This understanding traces its property rights roots and hence integrates government planning and land property as means to *private planning* (**Lai 1997; Webster and Lai 2003, Platt 2004**).

As planning necessarily involves zoning, the discussion of zoning is by implication not immune to the plan-market dichotomy. Some apparently simple terms are legal jargons for a particular jurisdiction. For instance, when **Fonoroff (1960)**, **Libby (1964)** and **Fischel (1978, 2000)** discussed “reasonable” and “unreasonable zoning,” they were referring to a judicial test for *constitutionality* of zoning by legislation in US only. That is, they were not referring to zoning in its generic sense as simply the division of land into lots, however that is done and whatever the reason or cause.

Property rights to land are not “land” *per se* but nor are they just “a set of social relations among people” (**Cohen 1954, p.365**). They are a set of *de jure rights* that govern social relations with respect to land, and physical boundaries as lot boundaries feature in these rights.

Note that in terms of heritage conservation of historical towns, the **ICOMOS (1987)** Washington Charter requires that in preserving the historic character of the town or urban area, particular attention has to be paid to “urban patterns as defined by lots and streets,” i.e., the foundational layout of the town. This layout is a “diagram.” As we shall see, we may call a town based on such foundational layout a “diagram city,” after **Kostof (1991)**.

Foglesong (1986) commented that colonial US plans “typically provided for an orderly street system; for generous open spaces, including a town common; and for central placement of public and quasi-public institutions, such as the administrative offices of government, the church and the market place” (**Foglesong 1986: p.28**). He lamented that the capitalist

forms of land ownership “served to undermine many of the positive, community-serving advances of colonial town planning” (**Foglesong 1986: pp.28-29**). What is the mode of this nice typical colonial American layout praised by Foglesong but condemned by **Grant (2001)**? The answer is the grid or checkerboard pattern of town layout, typically work of the surveyor as town planner.

Contrast his view with this of **Nye (2003)**, who considered laying out as a precondition for market development:

“Surveying was the essential precondition to owning land, building a mill race, or constructing a canal, railroad, or irrigation ditch.*Surveying was a kind of writing on the land*, turning it into a free-market landscape. Before the surveyor measured the land according to a repeatable and verifiable system, legal ownership was literally impossible.” (**Nye 2003: p.16: italics authors**).

We shall elucidate the specific economic benefits of Nye’s surveying as “writing on the land” in terms of transaction costs and public goods, treating it as synonymous to laying out a plan.

5.1 Containerisation and land unitization compared

Ford (1999, p.904) described a territory (such as a town) as “a container that holds a bundle of individuals and resources.”

Before listing the types of transaction costs saved by physical planning, we may compare the result of laying out a place as unitizing land into smaller units of similar shape and size to that of containerization in transportation.

Thanks to the experiment of Malcom McLean, this mode of goods movement emerged as a more efficient way of unitizing batched or consolidated goods. Many studies on transaction costs have been produced on containerisation but few have touched on the transaction costs saved by containerization itself (see for instance **Gans 1995, Cho 2014**). The standardized container or ‘box’, in grouping goods carried, facilitates measurement, drastically lowers the costs of logistics assuming, of course, the necessary supporting infrastructure (notably ports, highways) and hardware (ships, trains or aircraft, tractors and trailers and port facilities) are in place. It also co-promotes mass production of standardized goods and packaging not least by so lowering transport costs that distributed, just-in-time manufacturing is economically feasible.

The logic of containerisation applies *somewhat* to land unitization in laying out land, even though land is fixed in location and does not move. Unitization drastically lowers the transaction costs of measuring land through standardization. Partitioning a vast piece of territory into manageable blocks according to a layout, say under the US *Federal Land Ordinance*, is a process of unitization of this major natural resource. It processes the land into quantifiable and easily manageable units by defining the shape and area of the resource and establishes the legally recognised and protected boundaries of the units of the resource in a definitive spatial relationship. Under this relationship, a host of transaction costs can be saved, especially where the land units are of very similar shape and of size, though the process of surveying and dividing up incurs its own type of transaction costs. Land unitization in the US allowed for “checkerboarding”, an expedient (but not

necessarily agreeable) method of allocating land between Native Americans and early settlers in the country’s frontier areas reachable by rail.

5.2 Transaction costs incurred in layout planning

The costs of surveying and drafting layouts are important types of transaction costs that are either absorbed by the government or, as in the case of US, recovered by land sale by land companies that acquired rights from the state to open up and lay out towns. These costs (of x) incurred are surely more than compensated for by the greater saving in transaction costs (of y) due to such professional activities.

In countries where private property rights are evolving, such as China, the delineation of property boundaries for modern urban developments may refer more to landmarks rather than to a precise measurement of boundaries. The “red line map,” the cadastral plan, is known only to governments and landowners, but not anyone else – perhaps to avoid unnecessary disputes. One of the authors inspected one such map and recalled that it referred to the location of a big tree (or something similar), which was odd, since something like a tree can be easily removed!

The interesting question is why the country did not hire a surveyor to measure the property. This could have happened because of historical circumstances. In the US, for example, President George Washington was a surveyor, who personally mapped the site of the present-day White House. It is not clear what method was used to draft the US *Land Act* of 1796, however. Where the rectangular system of surveying a township was

established it consisted of six square miles that were potentially dividable into 36 sections of 640 acres each (**Gates 1936, 1968**).

Clearly, the technology of surveying is relevant to this view. Without using accurate surveying tools, surveyors cannot draw accurate boundaries even though they can exist as hypothetical concepts. But a hypothetical concept, such as a legal description, can only be implemented if it can be located and measured. If not, it’s just a legal description and remains hypothetical. Thus, the transaction costs in layout planning are also largely dependent on technology. If not, whether legal or otherwise, it’s just a legal description and remains hypothetical. One thinks of the classic ‘promotions’ of mythical land opportunities such as the Marquis de Rays’ New France in 1880, complete with spurious map, which promised all shareholders a hectare of land with native workers, neither of which existed (**Cocoual 2011; Barrault 2013**).

5.3 Savings in transaction costs by formal layout planning

The first step in planning a new settlement area after a land survey is dividing up the land into lots. Each is given a number, usually with a distinction between towns and rural or farm lots. In the Roman Empire, this was called “centuriation” (**Haverfield 1918, Romano 2003, Sparavigna 2015**) while in more modern times it is called “laying out” or “land division”. The typical shape of the layout was orthogonal because, as we have seen, it is the simplest procedure.

The process of producing a *foundational layout* involved is a “productive process” (**Haken 1930, p.22**): it seems easy like cutting a piece

of cake but the result is hardly a reversible *production* process in any stable society, any more than is cutting a raw diamond (**Lai and Chau 2018**).

Town lots and the public roads that serve and define them together have typically followed a chessboard or grid (i.e., orthogonal) pattern (**Neunzert, 2010**). **Marcuse (1987)** related the grid system to three phases of capitalism but did not specify how the process actually operated in economic terms in each epoch.

5.3.1 Lowering the costs of competition

In terms of property rights economics, the process of delineating land into exclusive zones is one that reduces the transaction costs of land users doing their business in a “common” or “communal” property rights regime (**Gordon 1954, Cheung 1970, Alchian and Demsetz 1973, Allen 1991b**). Without the delineation of a degree of *exclusive* property rights to land in the form of land units within an area defined as a “town” or “country” the area is a large *de facto* commons. In consequence, rent dissipation due to the huge transaction costs of competition for land could become serious. **Ford’s (1999: p.904)** description of a territory as “a container that holds a bundle of individuals and resources” must be qualified by the fact that this “container” cannot work unless any *competition for land* it contains is ordered.

Even where there is a tight control on migration, the transaction costs of *competition for land* under such communal rules as ‘first come first served’ or by squatting would be high. **Allen (1991a)** studied the puzzle of why homesteading (granting) was used in Frontier America rather than by auctioning out public land, which was the practice prior to homesteading. His

finding was that competition for land has many dimensions. Aside from the inefficiency of occupying land that has small use value at the time a claim is made – a point borrowed from **Barzel’s (1973)** notion of premature innovation – **Allen (1991a)** hypothesized that the US Government chose a seemingly inefficient form, which involved non-price allocation (see, also, **Akee 2009, Akee and Jorgensen 2014**), to allocate land because of the lowered cost of defending property rights against hostile Native Americans. The competition here refers not only to the transaction costs of legal delineation, but also to the transaction costs of competition by violence between Native Americans and American settlers.

Even for sophisticated economies, in which property rights over land and real estate change hands (exchange of ownership) frequently, there remain transaction costs that address the actual use of properties, particularly in the fringe areas of the boundaries separating two adjacent properties. This type of competition for the use of space through, say, planting flowers too close to the neighbor’s property, can be managed by what economists have theoretically labelled as “Coasian bargaining.” A codified boundary line allows this bargaining process to be conducted with much lower transaction costs, as both parties have a reference point by which to measure whether something is “too much” or “too little”. Competitions of this type are usually for scarce space. The higher is the market value of a property, the more likely one would expect this type of competition to occur. It is also conceptually different from those over open spaces under common ownership.

All in all, a foundational layout that unitizes land is an efficient vehicle to reduce the transaction costs in such competition for land, whether that is due to dissipation of rent caused by overcrowding, dissipation by violence, or simply self-interested, motivated use of extra space. It avoids the so-called “tragedy of the commons” due to *de facto* open access. Indeed, it establishes the first land market for the town it ‘founds’ and shapes subsequent property transactions.

5.3.2 Lowering costs of allocation, identification and subdivision of land

The preparation of this *foundational layout*, or the *primeval town plan*, itself absorbs the transaction costs of land surveying. In a hostile natural terrain in which such surveying could be a highly risky and uncomfortable task these could be high. Consider this vivid (but racist) description of the American surveyors: “The surveying of land remote from settlements was a hazardous undertaking because of the Indians. Since the discovery of America the red men had watched their domain shrink before the incessant advance of the white men, and they knew that fresh settlements and farms meant further spoliation. So it was a matter of poetic justice that the Indian should have a violent hatred for surveyors and for the surveyor’s compass.The melancholy scene of a wrecked camp, dead and scalped surveyors, papers strewn about, and a smashed compass, was not an infrequent result of the Indian's animus.” (**Arneson 1925: p.94**).

However, once the place is surveyed and the boundary of the town is defined, the surveyor can plan and serialize the land lots. The prevailing approach has been and is to use roads and drains to form grids within which land is divided into lots. This is actually the way laying out is done. Some grids are

reserved for government and open space purposes but most are for private use. The resulting chessboard or gridiron land lot pattern, preferred by Thomas Jefferson for Washington (**Reps 1961**), may seem to some unimaginative and problematic in terms of modern vehicular traffic management.

However, its antiquity is surely a clear indication that it is orderly and makes a lot of sense in reducing, even if not necessarily consciously, three significant types of transaction costs, namely (a) those associated with *land valuation and allocation*; (b) those associated with *property identification* (for easy addressing by street name or lot number) and *transactions*; and (c) those associated with *sub-division* and *reassembly of land*, to be explained below in comparison with the contemporary radial or more modern loop or *cul-de-sac* layouts.

5.3.3 Lowering the costs of valuation and changing a layout

Before the land for the town is cleared of forests, levelled and serviced and in any event before allocation, the plan can be easily amended like in redrawing a picture or diagram from scratch.

However, once the land lots have been marked out and are allocated to users, and roads are developed (later along with sewers and drains), any such plan becomes increasingly rigid with time. **Friedmann’s (1994: p.377)** statement that “while planners plan, the world moves on, for the most part without regard to the plans so carefully drawn up and so quickly outdated” had nothing to do with this primeval town plan. In Friedmann’s mind, the plan was not this kind of plan (i.e., Abercrombie’s layout) but subsequent planned

attempts to modify things that resulted from such plan; in short, Friedmann begins from a foundationally planned world, not from a *terra nullius*.

The ancient centuriation and the modern grid system save the huge *transaction costs of designing, site preparations for and allocating land parcels*. As the government has huge transaction costs to evaluate each and every location in a town area and match them with suitable users, it relies either on auction or some other means for the initial allocation of property rights. The *transaction costs of valuation* for each lot are shifted to the prospective buyers, who have a greater incentive to pay them as well as, comparatively, creating idiosyncratically useful information about the sites. Containing rectilinear lots with road frontages, this system lowers the *transaction costs of sub-division and subsequent reassembly*. The *cul-de-sac* pattern of land division or subdivision is highly inconvenient for further partitioning or re-combination, i.e., inflexible. The point is simple: dividing a rectangular space into whole portions (half, third, quarter, fifth, sixth, eighth, etc.) is a basic exercise in plane geometry; but dividing an irregular, curved bordered space into parts, whilst formally doable, is complex (**Amen 2011**).

5.4 The public goods nature of the land division plan

That zoning reassigns development rights and obligations is a line of thought that articulates with the familiar debate between interventionist and liberal theorists in planning in the shadow of the plan-market dichotomy. Sub-section 3.3 above argues that it saves the transaction costs of competition for land, for valuation and allocation of land, and of zoning control.

Of even greater theoretical interest is that the layout for a town is in itself a public good. First, it is a way to pool people and capital together as a common good. This follows from the fact that man is a social being, each dependent on others, thus requiring a *de jure* and *de facto* common place in which to interact. This place is defined in a town (or rural community) plan. Note that this pooling of people and things into a town in a form of spatial agglomeration is something which many land economists have seen as a public good (**Appold 1995**),⁵ without highlighting the *prior* need of some basic government planning framework. Agglomeration as concentration of activities inside a town without any internal partitioning of land into units for specified activities, as mentioned in Sub-sections 3.1 and 3.3 above, simply leads to the tragedy of the commons due to *de facto* open access. A town hawker bazaar without any internal rules governing competition for locations and space would only generate the high transaction costs of anarchy, the chaotic outcomes of which will predictably eventually be reduced by might to impose some order. Spatial agglomeration may only become a public good in a town if some rules for regulating competition for land are embodied in the town layout.

Second, for a particular society, and by derivation for society in general, the town layout establishes its overall proprietary and common setting. Though some areas will become private property, many others inside the town, notably its streets and paths, are reserved for non-exclusive use by those within and without the modern town, which is usually un-gated but

⁵ **Appold (1995)** did not believe that firms in agglomeration were efficient but did not give any reason why these agglomerations emerged in the first place.

open *ab initio*. That some townships may become gated and exclusive to others is something of a much later development.

Third, the information on a town layout, exactly like a survey map, is in principle a public good. It is well established that survey maps are public goods (**Siebrasse 2001, Rao and Murthi 2006**). Though the map or a layout as a specific paper (or now an electronic) document is a private good, the information it contains entails zero costs for an additional user provided there is unrestricted access to it. Important information contained in the layout, for example, concerns the addresses of private lots and the public uses of any space with such a use.

When a property entails certain public good aspects, with the most directly-affected aspects being street and utility access, certain public choice mechanisms will be involved. The size of a private lot, which can only be measured if there is a boundary around it for calculation being a measure of economic wealth and income of its owner or occupier, is a proxy for voting power regardless of the relevance voting has on the public choice mechanism of the public goods involved, as informed by Tiebout’s model. (**Fischel 1992**) As pointed out earlier in this section, for some emerging townships where the rule of the land is determined by violence, checkerboarding, with initial allocations being divided evenly between conflicting parties, could be a way to resolve or alleviate conflicts arising from violence. Once violence is rejected as an acceptable form of competition, as the Coase Theorem informs, an initial allocation will not materially affect the outcome of the uses of land by adjacent lots. The total area of land

owned by an entity, in any case, provides the voting power behind public goods uses.

6. Resilience of the first formal town plan and natural units of private planning

One reason why the primeval town plan formally made by the surveyor is so resilient is that it is fundamentally a vehicle for *private* planning and development. The owners of individual land lots are planners of their respective holdings (**Platt 2004**). The lot can be seen as a *natural unit* of planning and development for a town in the sense that it is a unit of land with its owner as planner, with his or her own planning purpose and horizon, free under common law from the fetters of strangers. It is a manifestation of the principle of subsidiarity.

Within the parameters of the prevailing law, each owner makes his or her own decisions, within the spatial limits of his/her land, independent of others or the state. Planning as such is decentralized but occurs within a physical framework laid down by government. Some examples of this private planning model are the “private zoning” of **Milwaukee (Beuscher 1958)**; “non-zoning” of **Houston (Siegan 1970)** based on restrictive covenants, and “planning by contract” in Hong Kong predicated on the terms of the government lease (**Lai 1998**). The ongoing story of government interventionist zoning versus libertarian spontaneous planning can only start from here with an existing platform or a “plat”.

Unless there are major earthquakes that change the face of the earth substantially as in the case of **Norcia (Montanari 2016)**, layouts of towns do

not easily change. Even severe earthquakes may not alter a town’s layout. In 1990, **Baguio** suffered a major earthquake. However, postwar reconstruction did not alter the old layout of its CBD. **Bhuj**, India, was destroyed by a violent earthquake 2001. With the help of an NGO, Environmental Planning Collaborative, the government implemented an after the event land re-adjustment (**Byahut 2014**). Lots were rendered rectilinear and streets widened by proportionally deducting land from original holdings. The result was impressive. However, even here the original through route was retained though widened and better connected with individual lots. There is a field of research that traces the continuing influence of Roman centuriation on modern urban and rural landscapes (**Rippon et al. 2015, Sparavigna 2015**).

Slater (1981, 1987) showed that a “long perpetuation of lot boundaries” in old Medieval “burgages” (“basic 'cells' in any analysis of medieval town plans” (p.211)) continued in **Winchester** and **York**. Suffice it to say that the morphology of towns does not easily change even with changes in the political environment. The planning history of **Taipei city (Wu 2010, Xu 2014)** is a case in point, as illustrated in a series of maps. Figures 1, 2 and 3 show, respectively, the Manchu city as it was taken over by the Japanese empire in 1898, the city re-planned as a colonial Japanese city in 1900, which was further replanned with walls demolished and replaced by a highway that rings the city in 1910. Figure 4 shows the overlays of 1898 and 1900; and Figure 5 those of 1898 and 1910. The 1898 layout shaped a subsequent plan of 1900 or 1910, testifying to the resilience of the first layout prepared by the Manchu Chinese surveyor-planner, who had to accommodate some preexisting uses.

Figure 1, 2, 3, 4, and 5 about here

7. Discussion and conclusion

~~There are three types of layouts, namely (A) layout plans *de novo* imposed on virgin country; (B) layouts that are *de facto* 'plans' in virtue of their having come into existence by whatever historical trajectory they did; and (C) layouts imposed on EITHER layouts type A or type B. This paper deals only with Type A layouts, while types B and C layouts are the subject of another paper.~~

It is not a hypothesis but a rediscovery, a fact, based on **Home's (1997)** research as elaborated by **Lai and Davies (2017)** that the surveyor was the town planner in the “new world” who produced type A “layouts” or “plats.” The significance of this fact is little appreciated though it might be mindlessly mentioned in planning history works. The surveyor's layouts (plats) are the foundational or primeval town plans for many cities and this fact has been ignored in planning research.

This paper explains that the first layout of a town or city in the “new world” was traditionally the work of a surveyor, which impact has been lasting. Even where the origin can be seen to have been less formally surveyed, the first layout of a permanent settlement has similar long-term influences. So long as human beings have bodies and by and large dwell in buildings as real properties, a layout is an essential vehicle to delineate development rights for allocation to land users. Typically following a grid iron pattern, with

roots in ancient history, the layout of the surveyor may not look attractive. Yet, it has stood the test of time and continued to condition modern development.

It serves two significant economic functions. First, it reduces several types of transaction costs namely those of competition for land, valuation allocation, identification and subdivision of land as well as revising a layout. Second, it serves to achieve agglomeration, establish a proprietary and common setting; and provide vital information as different forms of public good.

Some points of interest are noteworthy. First, in one sense, the “foundational plan” layout defines both public and private spaces for the same place. In another, with the public and private spaces laid out (and so defined), space is opened up WITHIN the private spaces for more or less trammelled INTERIOR layouts. This leads to questions relating to development controls (i.e. what can and cannot be done with a private space (q.v. externalities)) that are beyond the remit of this work.

Second, “boundary delineation” as bearing “public good” characteristics must not be seen in terms of as a dichotomy between public activity by the state or a consequence of private activities (contracts, exchanges, private development plans, etc.). Many foundational layouts or plats were products of development companies (**Lai 2014b**), which obtained rights from the state to open up land. The point is that planning necessarily involves boundary delineation (of blocks, lots, roads) that is proprietary.

Third, this paper does not deal with the general concept of a boundary (that which demarcates Area A from Area B through N in any arrangement of human space at any scale and which may be more or less exact (i.e. range from Euclidean to penumbral) (**Lai and Davies (2017)**) but the very specific 'lot boundary' within a layout or plat, the ideal type of which is the Euclidean line between Euclidean cadasters.

Fourth, there is a need to clarify the meaning of “physical planning” as the context for our discussion of layouts in economic terms. “Physical planning” we older planners learnt as a subject in old planning schools but it would be hard at any time to find any good definition of it from any textbook or paper. Most authors presumed the reader knows what it means and thus deals with the problems “it” tackles. **Dickinson (1942a, 1942b)** specified “four sets of interrelated problems” physical planning had “to contend with”. They were rehousing of people in inner cities; suburban living, decentralisation of population and industries from congested urban centres to their fringes, and dispersal to farther places. **Fuchs (1944)** gave the “the three basic elements of physical planning” (namely Earth, Man and Work) but did not state what physical planning is. ~~Malawi has an Institute of Physical Planners (MIPP) (**Manda 2013**).~~ There are university departments called “physical planning” in many developing countries. **Wilson and Cripps (2014)** advocated an integration of between “physical planning” and “socio-economic planning” for such entities but the discussion did not depict physical planning. In this paper, we elucidate the importance of layouts as outputs of physical planning.

The following official narrative is also useful to highlight the significance of layouts. “In Malawi, physical planning came with the British colonialists who prepared the first street plan for Blantyre. The origin of the Department is a Town Planning Section that was established in the then Public Works Department in 1962. In 1968 a Physical Planning Division was established in the Office of the President and Cabinet (OPC) to deal with rural development matters. In 1971, the Physical Planning Division of OPC was amalgamated with the Town Planning Section of Ministry of Works and Supplies to become the Department of Town and Country Planning under OPC.” [<http://www.lands.gov.mw/index.php/about-physical-planning.html>]

Furthermore, two sorts of physical planning outcome can be distinguished: (a) the 'physical' (i.e. instantiated) plan in the form of distributed understandings in human 'wetware', large sheets of paper or complex CAD software; and (b) the 'physical' place (bricks and mortar, tarmac, gutters and kerbstones, buildings and open spaces).

On a more general theoretical plane, this paper offers a modern Coasian neo-institutional interpretation of the economic benefits of formal layout planning for a “new world” discovered by colonial powers, who ordered land grabbed to be handled by surveyors (like George Washington, Thomas Jefferson, Ronald Alison McInnis, John Septimus Roe, Robert Hoddle and William Light), often with military background, as town planners. No reference is made, accordingly, to its original classical Graeco-Roman political rationale. The transaction cost reduction and public good merits, claimed for a primeval or foundational layout the surveyor produced in the distant past, in this paper can be summarised as this benefit: for any such

place it provides clear definition of property rights to accessible and spatially well-delineated units of land for private or public uses. In short the realty (real property) foundation for a land market as enabled and regulated by the state. These units are homes, churches, schools, farms, factories, parks, cemeteries and the like.

Due to proprietary interests and concerns, such a foundational layout can withstand subsequent forces of change (as in the case of Taipei) or damage by war (Berlin and Nagasaki) and natural disaster (Norcia, Baguio and Bhuj). A renewed sensitivity to the benefits and resilience of the primeval layout of any place so initiated would help better understand both the socio-economic consequences of physical planning for growth poles in growing developing countries, which are repeating what happened to developed countries 100 to 200 years ago, as well as the need for land readjustment, transfer of development rights and other institutional mechanisms for dealing with constraints posed by urban obsolescence in cities developed countries.

It is hoped that this paper will kindle an interest in the economic contribution of the work of the surveyor to land use planning by “writing on the land,” cleaving wild territories into orthogonal “diagram cities” and fields as units for private planning and development. Physical planning or urban design theory may hence be enriched by a re-discovery and re-assessment of its surveying roots and its economic dimensions.

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