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Fundamentals of cities

GEOG-325: Applied Spatial Statistics and Urban Modelling

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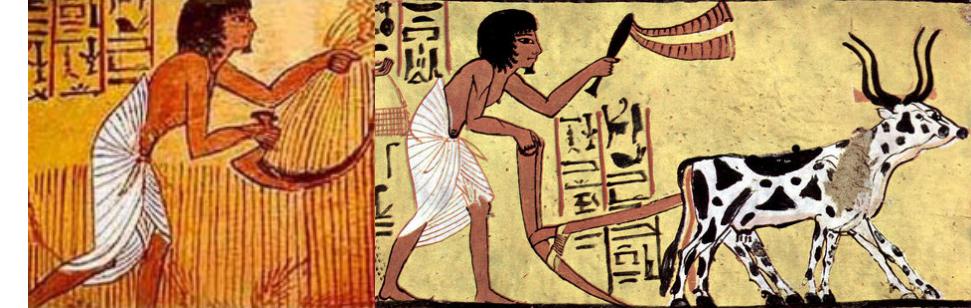


Three fundamental questions about cities

- Important to distinguish between **why**, **where**, and **how** cities exist.
- Keeping these fundamentals in mind helps you use empirical methods in a more coherent way
- **Why** refers to the reasons humans chose at some point in prehistory to settle.
- **Where** refers to the locations in which cities happen to be.
- **How** refers to the way cities look and grow.

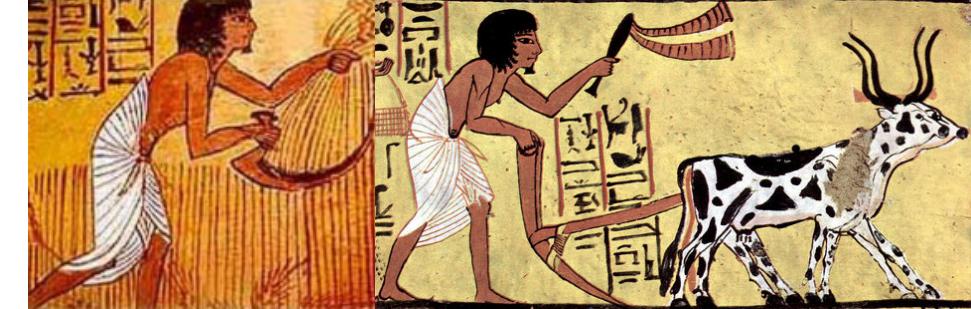


Why do settlements exist?



- Archeologists tend to focus on the **Neolithic transition** (ca. 12500 BCE) **from mobile hunters-gatherers to settled farmers**.
- Not a simple transition: small dispersed village communities -> larger more complex social-political formations -> emergent chiefdoms/states -> cities and urbanization [after Birch 2013]
 - Farming implies a more-or-less permanent settling
 - Food productivity per unit of space and per person-hour ↑
 - Food surplus ↑
 - Time to develop other activities, incl. arts, crafts, know-how ↑
 - Population and population density ↑
 - Change in the economic system
 - Differentiation of skills, emerging of social and political clusters [after White 1959; Plog 1974]

Why do settlements exist?



- Also, linguist Noam Chomsky's idea of a universal grammar forms the basis of discussing that the human **mind** has **hardcoded** in it the ability to produce **architectural forms**, much like it does for language.
- This fits well with Jean Baudrillard's argument that humans are confronted by abstract, infinite space and that the architect is then confronted with the problem of filling this space.
- Next, cultural semiotics (Claude Levi-Strauss, Umberto Eco) describe that urban space (i) both reflects and influences social structure and (ii) serves two purposes: denotative ("function") and connotative ("symbolism").
- It seems that as the agricultural revolution was progressing, it brought about settlements due to certain functional needs, as well as sociocultural and evolutionary features of humans.

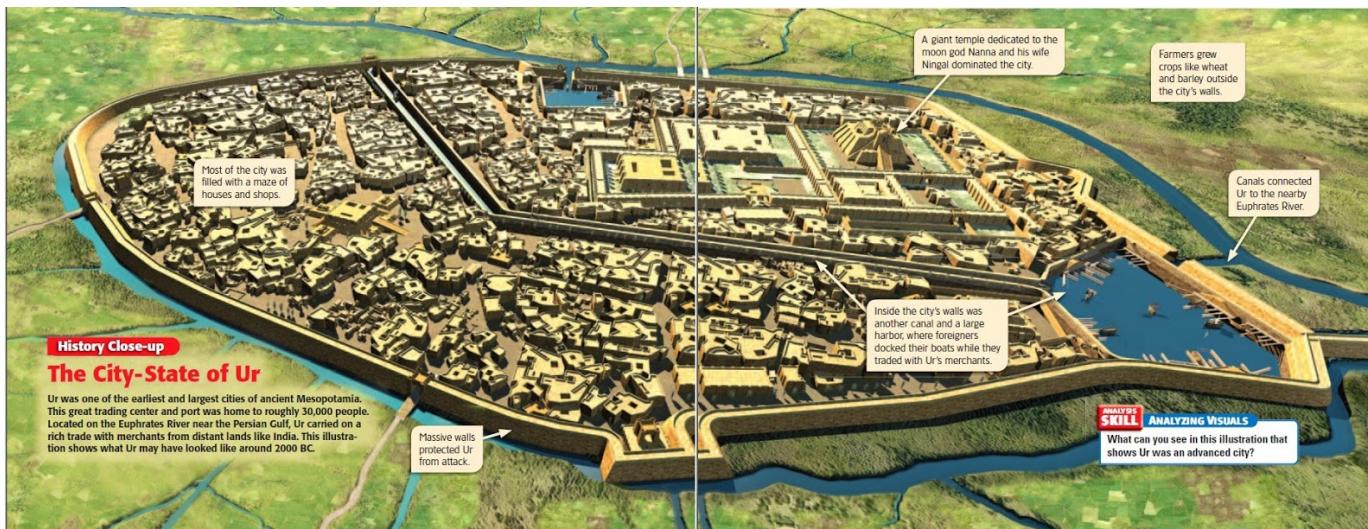
Examples of early settlements



Göbekli Tepe (SE Anatolia), f. ca. 9000 BCE ↓



↑ Çatal Höyük (SE Anatolia) f. ca. 7500 BCE



Ur (Mesopotamia)
f. ca. 3800 BCE →

Where do cities happen to be located?

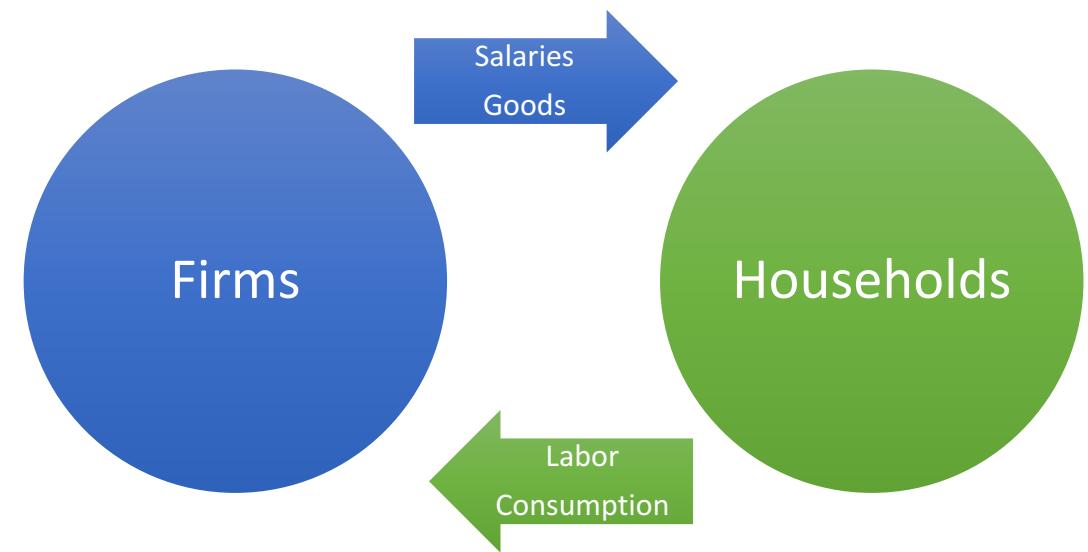
- Batty (2007) discusses five drivers:
 - **Randomness**: impulses, irrational behavior
 - **Historical accident**: political decisions, chains of events (e.g. landing on a certain coast)
 - **Physical determinism**: topographical constraints
 - **Natural advantage**: natural endowment (e.g. fertile plains, hilltops, coasts)
 - **Comparative advantage**: cost-efficiency of producing/offering a feature
- These drivers should be seen as **processes**; Batty calls them drivers of change.
- Economic geographers usually discuss a narrower set of drivers:
 - Natural advantage; comparative advantage; competitive advantage; political decisions

How do cities grow? The AMM model

- We can describe how cities grow, and what spatial form they assume, by referring to the Alonso-Muth-Mills (AMM) family of models.
- Most developed and validated theoretical foundation of urban studies.
- Starts with an existing hub of human activity (e.g. market, port, mine)
- Is built around five main elements:
 - Interactions between firms (production, jobs) and households (consumption, labor)
 - Location preferences of firms and households
 - Resulting land value
 - Resulting land use and density

The AMM model

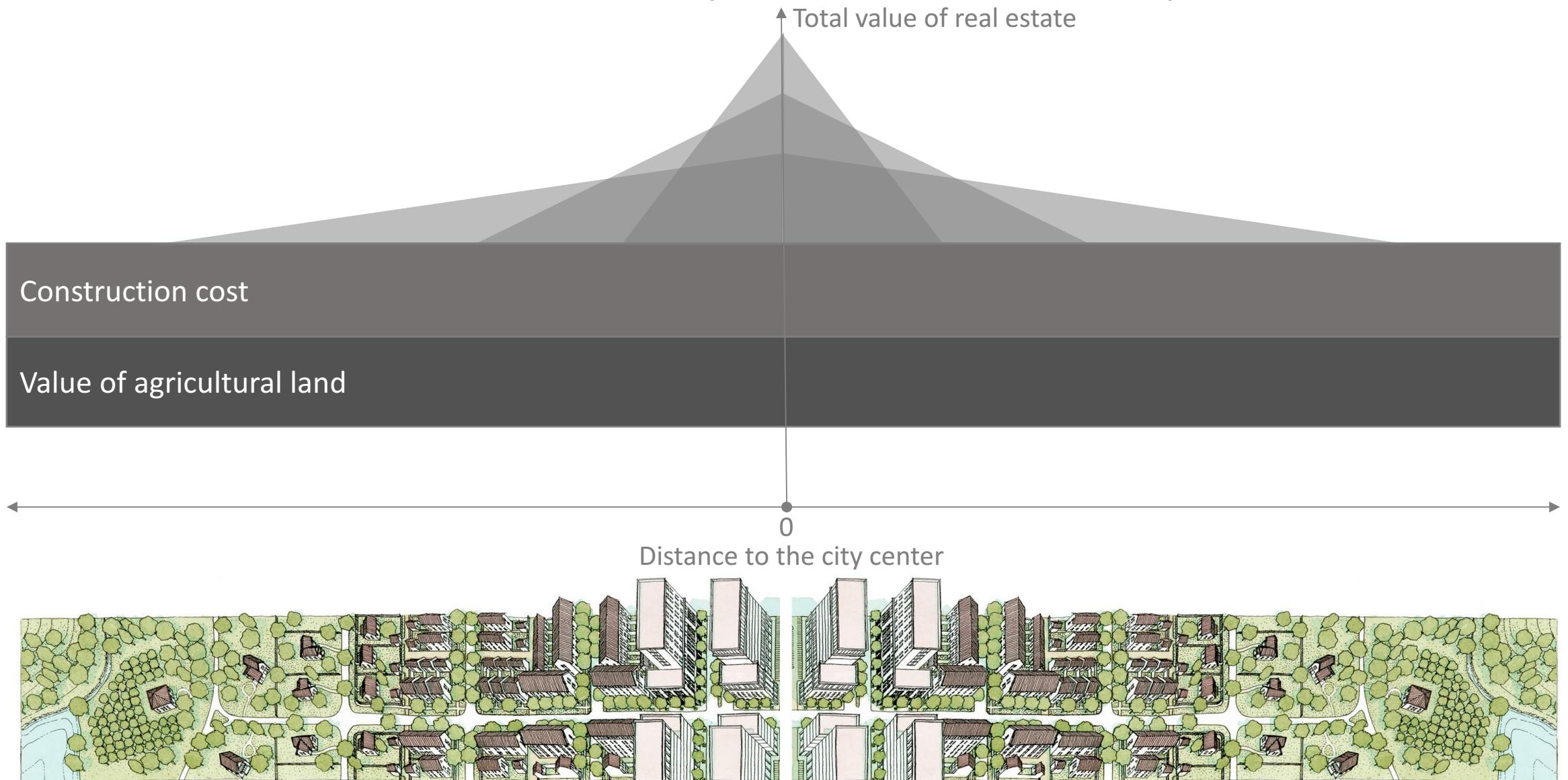
- Start with a center of activity (port, mine, farming, military, railroad junction).
- Firms, e.g. producers or distributors of goods (industries, merchants, ...) are more productive and cost-efficient when they cluster together (e.g. they share infrastructure, knowledge, services).
- Households are also better off clustering together (sociocultural needs, safety, ...) and around jobs, which is true for firms as well.
- The idea is that both firms and households benefit from agglomerating, because they share resources, accommodate each other, and in the end establish a circular economy.



The AMM model

1. As distance to the center (“CBD”) increases, commuting costs rise, whereas households and firms are characterized by spatially uniform utility and profit.
2. Point [1] implies that land rent and, consequently, building density decrease as distance from the CBD increases
3. Point [1] also implies that as distance to the CBD increases, housing price per unit of space decreases, and consequently the density of dwellings decreases.
4. Points [2]-[3] imply that the density of urban development decreases as distance to the CBD increases. In the CBD, high land rent and property prices per square unit drive land to be used in ever-decreasing fractions: high land rent -> less floorspace/person.
5. Considering multiple land use(rs) implies that commercial land use will dominate the CBD, residential land use will be typically found near the center, while agricultural land use is found in the urban periphery.

The AMM model, implications for spatial form



The AMM model: amenities

- Points [1]-[5] describe the land use of a monocentric city. Adding two household income groups, introducing three types of spatially variable amenities (natural, historical, and cultural), and assuming a positive valuation of amenities (Brueckner et al. 1999; Brueckner 2011) result in:
 1. High-income households locating near exogenous ecological and historical amenities.
 2. Cultural amenities (e.g. cafés, art districts) endogenously appearing in high concentrations of high-income households, which in turn attracts further investment and high-income residents.
 3. Decentralized employment hubs and a spatially heterogeneous transport infrastructure will further disrupt the spatially uniform utility of households.
 4. Points [6]-[8] yield a multicentric city in which the geographical distribution and variation of local environmental conditions are both a driver and result of wider spatial processes.

The AMM model: amenities

- Residential location theory typically considers two factors:
 1. **Preference on generic dwelling type** (e.g. single family, apartment), and then
 2. **Transport cost** (and accessibility)
- If natural amenities (and historic, cultural amenities) are **evenly distributed** across a city, then transport cost remains the defining determinant of household and firm location patterns, and of land/property prices.
- If natural (and cultural, historic) amenities are **unevenly distributed** in urban space, then they become defining drivers after controlling for transport cost.
 - They **co-determine land/property prices**.
 - They **influence firm and household location patterns**.
- Condition: economic value of natural land uses depends on their **scarcity, density** of built environment, and **urban development dynamics**.



Empirical verification at the microscale

- Empirical evidence from households when *buying* their homes mirrors/confirms the theoretical constructs of the AMM model.
- Regressions (called “hedonic regressions” because they assume that more of a good thing adds to household utility and more of a bad thing reduces utility) show indeed that the price of dwellings is a function of:
 - Structural attributes (e.g. dwelling’s condition, age, size) [\[AMM: construction\]](#)
 - Locational attributes (e.g. distance to the center and to transport nodes) [\[AMM: location\]](#)
 - Neighborhood attributes (e.g. green spaces, noise) [\[AMM: amenities\]](#)
- If you aggregate household behavior as shown by hedonic regressions, you reach at the AMM model’s general suggestions.

Points of attention [1/3]

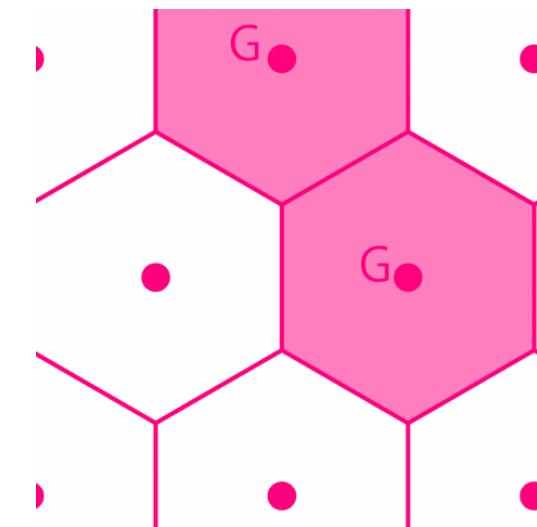
- The AMM model applies to multi-centric cities, too. Think of the center as any kind of activity hub: metro/train station, interesting locations, etc.
- The main implication for urban policy and urban planning is that cities are the result of high productivity per unit of space due to agglomeration of “many good things”.
- Where things are located matters and there is inherent competition to locate at certain places inside a city, because attractive land is scarce.
- In other words, cities and land use follow a very specific mentality of spatial optimization.

Points of attention [2/3]

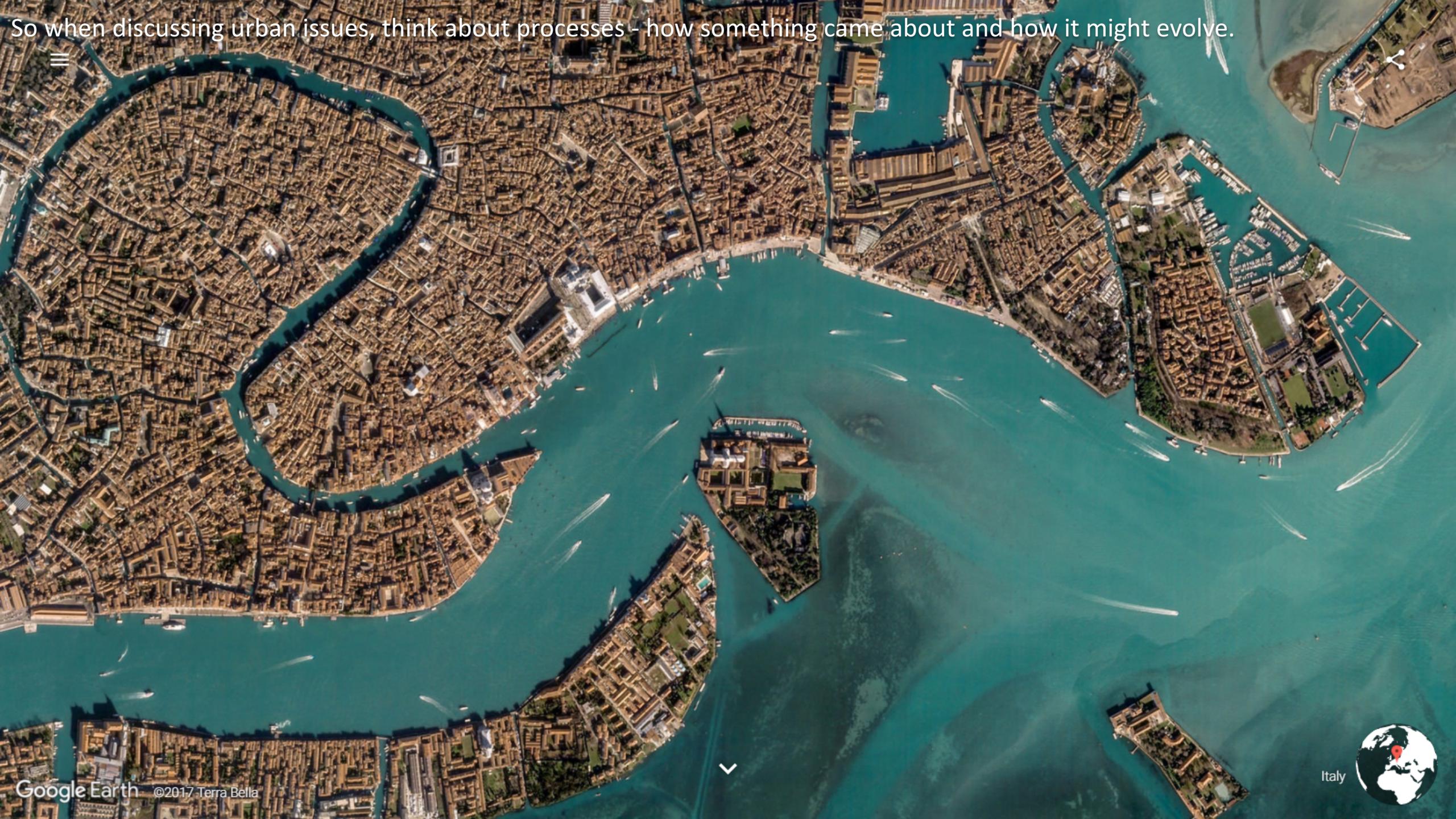
- There are some notable problems with the way cities grow, *only some* of which are:
- Less competitive land uses, notably ecosystems, get minimized or completely expelled from high density places, because they are not seen as productive.
- Dense agglomerations produce externalities: e.g. noise, air pollution, crime.
- Housing supply tends to be inelastic to population growth (or any other change).
- For reasons such as the above, policy interventions are needed.
- **The 1M\$ question is: how to intervene (physically, behaviorally) without hurting the agglomeration forces that originally made cities successful.**
- A typical classification of interventions is: **taxation, regulation, investment, information.**

Points of attention [3/3]

- So far we have examined singular cities as closed systems.
- In reality, an *open system of cities* is in place, with additional factors to consider, notably:
 - Inflows/outflows of population and resources (goods, labor, money, services, knowledge ...)
 - Competition of cities (e.g. for investment, companies, certain population groups)
 - Size of cities and the size-hierarchy of cities (e.g. Zipf's law)
 - International flows (think e.g. New York, London-Paris-Frankfurt, Tokyo)
 - National and regional policies (e.g. investment, (de)regulation)
- For instance, central place theory, the rank-size rule, but also new economic geography are a few (of a number of) theories that are employed to describe the structure and hierarchy of a system of cities in a region, nation, or continent.



So when discussing urban issues, think about processes - how something came about and how it might evolve.



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Questions for this session

1. Why are successful cities dense, expensive, and with few large green patches?
2. Why do cities need policy interventions?