Lecture 2

2.1 Why Cities as Complex Systems?
Concepts of Organized Complexity and Human Ecology

- When can we understand (and intervene) in cities “one issue at the time”?

This is typically how city agencies and traditional urban planning and policy makers act:

- If the problems of cities are systemic, can cities be designed from scratch to be better?

Urban Utopias: EcoUtopias (Garden Cities), Industrial Utopias (Modernist City), Architectural Utopias (so many), Political Utopias (Brasilia,…), TechnoUtopias (Smart Cities), …

- From the beginning, many urbanists argued that cities are *natural* social forms, with their own predictable, emergent properties not understandable from narrower approaches

For example: Aristotle, Patrick Geddes, Camillo Sitte, Robert Park and Ernest Burgess (Chicago School Sociology), Lewis Mumford, **Jane Jacobs,** Christopher Alexander, and many more recent authors

We will follow **Jane Jacobs** strategy, which is the most analytic, factual and scientific of these.

Your reading materials

BLOGGING

Downtown is for People (Fortune Classic, 1958)

If the downtown of tomorrow looks like most of the redevelopment projects being planned for it today, it will end up a monumental bore. But downtown could be made lively and exciting — and it's not too hard to find out how.

By Jane Jacobs

FORTUNE ARCHIVES

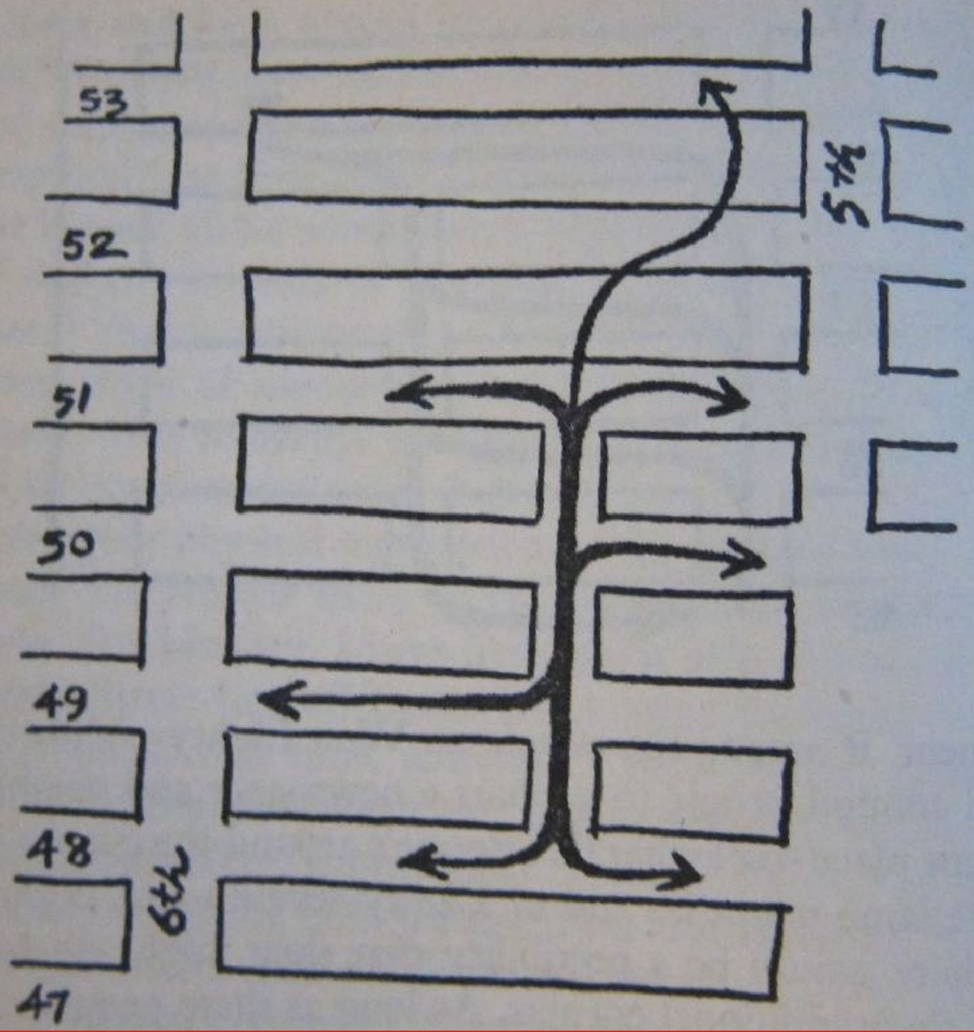
Jane Jacobs early breakthrough essay

think of cities for people, not just industrial infrastructure

This year is going to be a critical one for the future of the city. All over the country civic leaders and planners are preparing a series of redevelopment projects that will set the character of the center of our cities for generations to come. Great tracts, many blocks wide, are being razed; only a few cities have their new downtown projects already under construction; but almost every big city is getting ready to build, and the plans will soon be set.

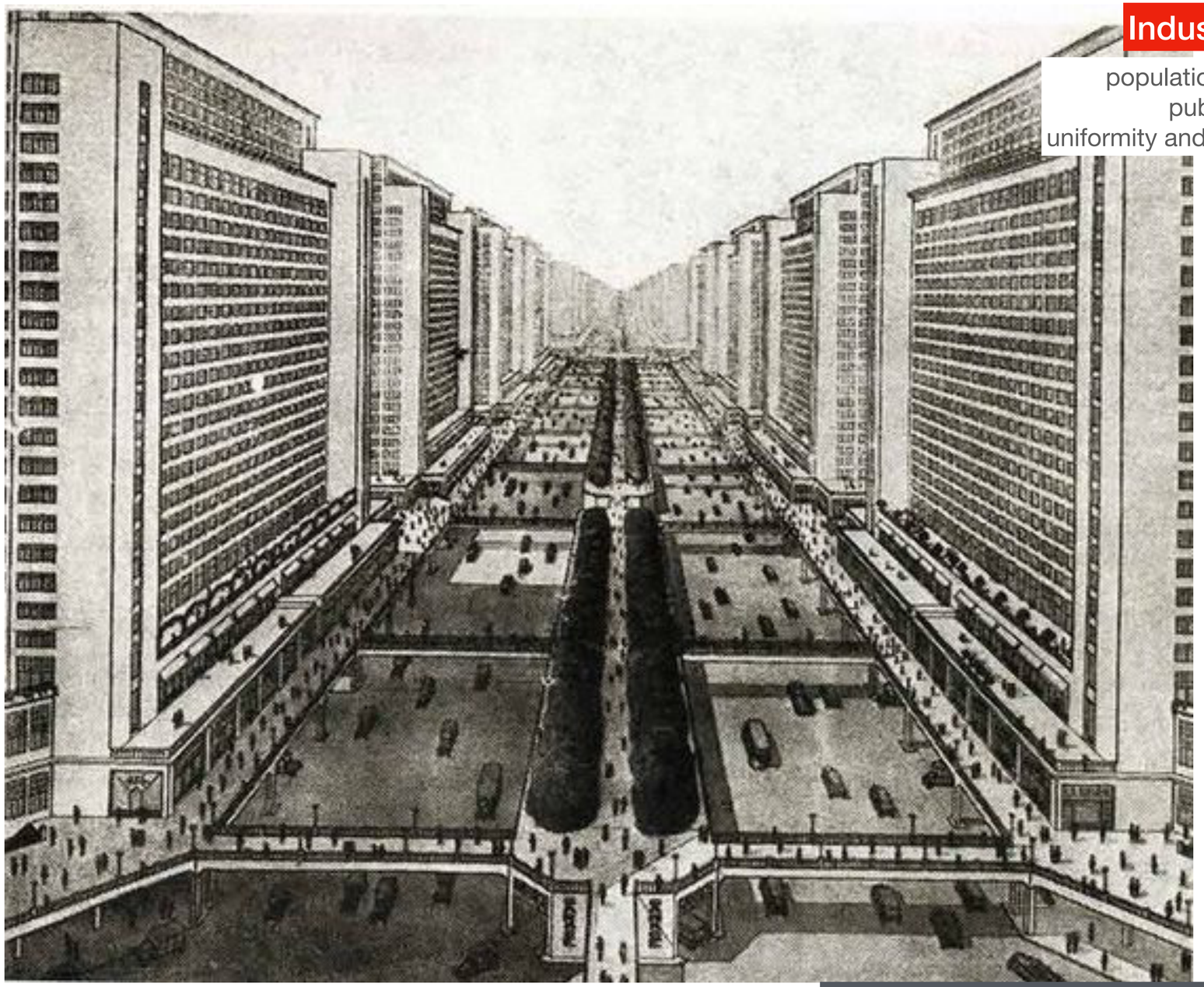
https://fortune.com/2011/09/18/downtown-is-for-people-fortune-classic-1958/

Jane Jacobs, The death and life of great American cities, 1961



Jane Jacobs *observed* how people use urban built spaces and what makes them successful or failures

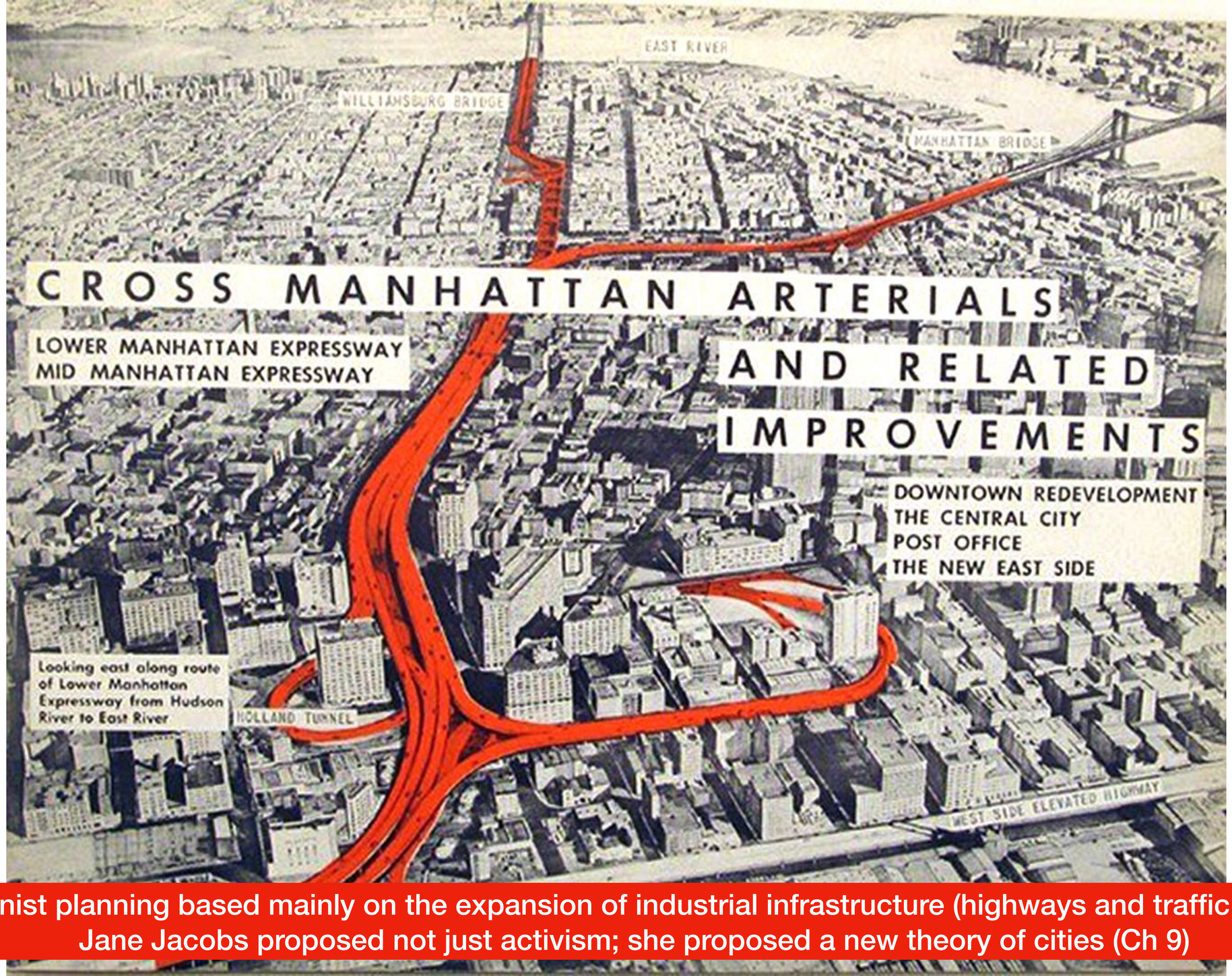
out its extra north-south street, Rockefeller Plaza. If the center's



Industrial Utopia

population density in the wrong places
public spaces given to cars
uniformity and drabness in the name of efficiency

Le Corbusier: Ville Radieuse 1924-33



To fight modernist planning based mainly on the expansion of industrial infrastructure (highways and traffic flows) Jane Jacobs proposed not just activism; she proposed a new theory of cities (Ch 9)

Jacobs' Criticism of Urban Planning and Policy

The death and life of great American cities, 1961

Reading: Chapter 22 "The Kind of Problem a City is"

Too Simple
Too Statistical ("bird's eye view", averages)
Too Sentimental (especially in dealing with Nature)

The wrong way of thinking to help create good cities

Cities are natural

The cities of human beings are as natural, being a product of one form of nature, as are the colonies of prairie dogs or the beds of oysters.

Cities are not "heaps of problems", they are the solutions

"Big cities have difficulties in abundance because they have people in abundance."

Vital cities have marvelous innate abilities for understanding, contriving and inventing what is required to combat their difficulties.

The surplus wealth, the productivity, the close-grained juxtaposition of talents that permit society to support advances […] are themselves products of our organization into cities, and especially into big dense cities.

pp. 566

Moreover, in parts of cities which are working well in some respects and badly in others (as is often the case), we cannot even analyze the virtues and the faults, diagnose the trouble or consider helpful changes, without going at them as problems of organized complexity. To take a few simplified illustrations, a street may be functioning excellently at the supervision of children and at producing a casual and trustful public life, but be doing miserably at solving all other problems because it has failed at knitting itself with an effective larger community, which in turn may or may not exist because of still other sets of factors. Or a street may have, in itself, excellent physical material for generating diversity and an admirable physical design for casual surveillance of public spaces, and yet because of its proximity to a dead border, it may be so empty of life as to be shunned and feared even by its own residents. Or a street may have little foundation for workability on its own merits, yet geographically tie in so admirably with a district that is workable and vital that this circumstance is enough to sustain its attraction and give it use and sufficient workability. We may wish for easier, all-purpose analyses, and for simpler, magical, all-purpose cures, but wishing cannot change these problems into simpler matters than organized complexity, no matter how much we try to evade the realities and to handle them as something different.

Scenario 1: “Private street”

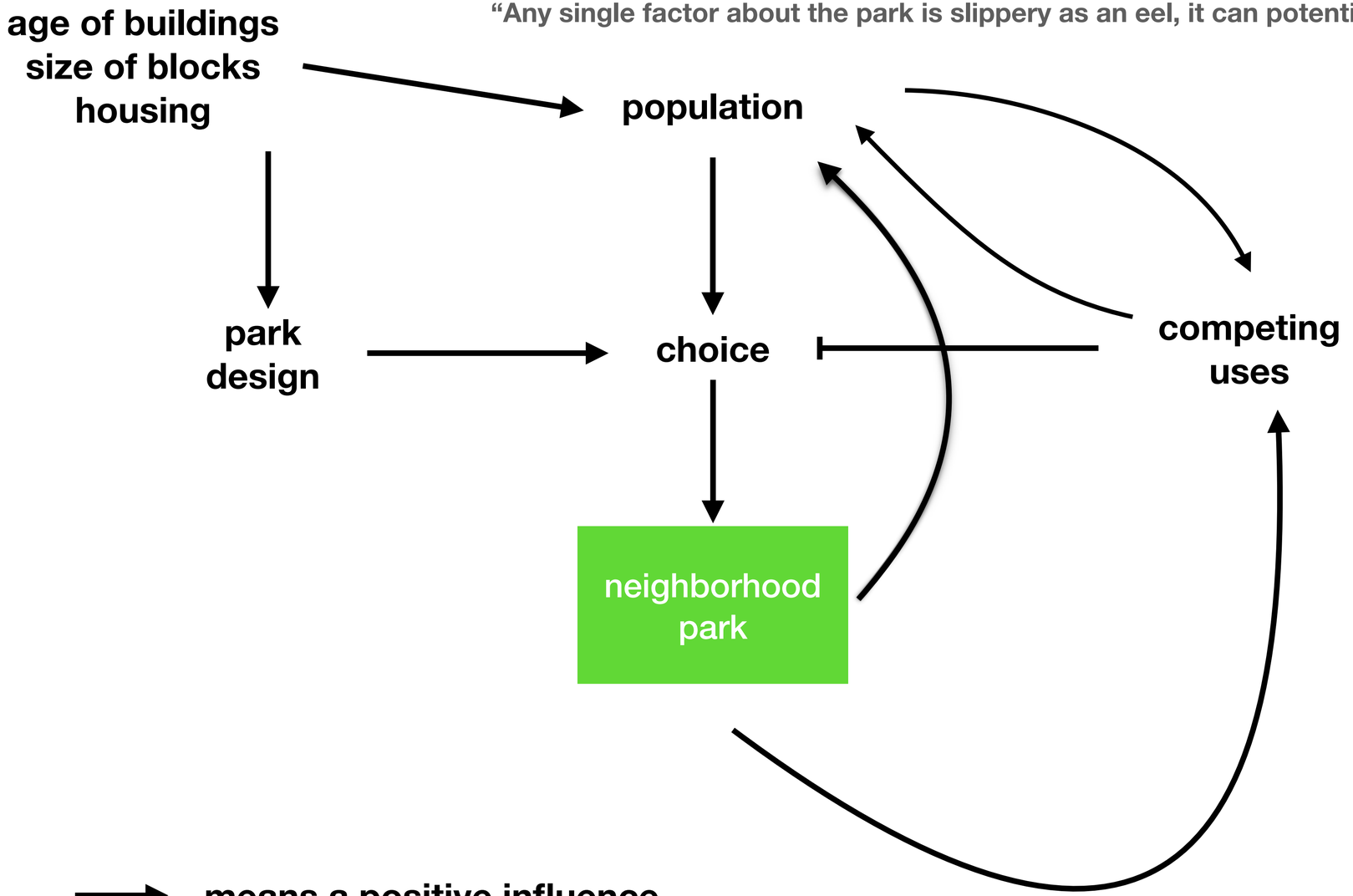
Scenario 2: local versus wider design

Scenario 3: centrality

Causal Diagram for What Makes a “Good” Park

Jacobs, Ch 22, pp. 565

“Any single factor about the park is slippery as an eel, it can potentially mean any number of things”



Your first assignment

means a positive influence

means a negative influence

The existence of loops in the diagram
entails circular causality
virtuous and vicious cycles + possible equilibrium

Causal diagrams are *probabilistic graphical models*

Representations of (conditional) probabilities

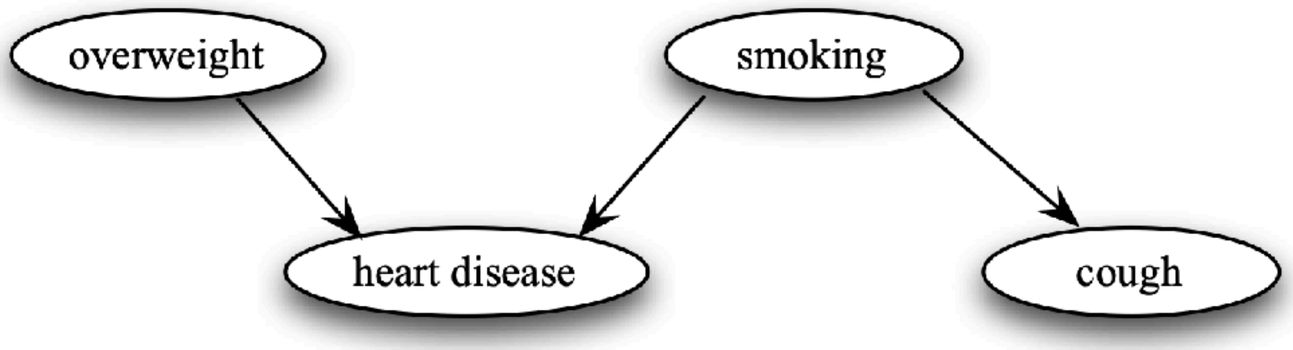


Figure 18.5. *DAG for Example 18.3.*

directed acyclic graph

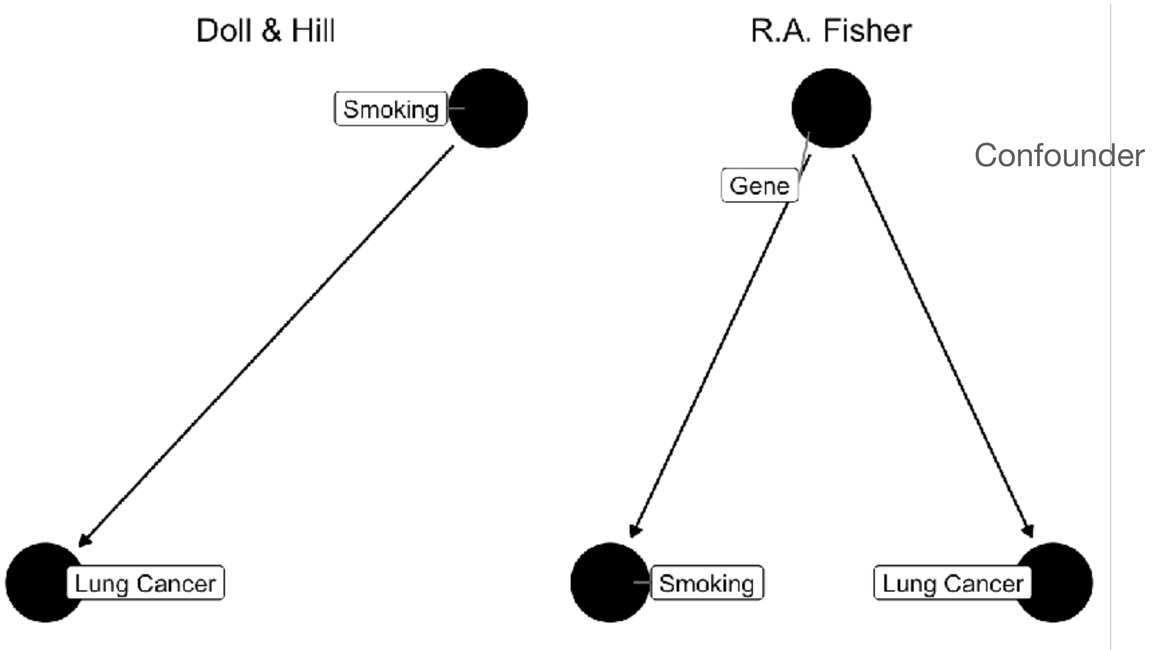
takes the following decomposition:

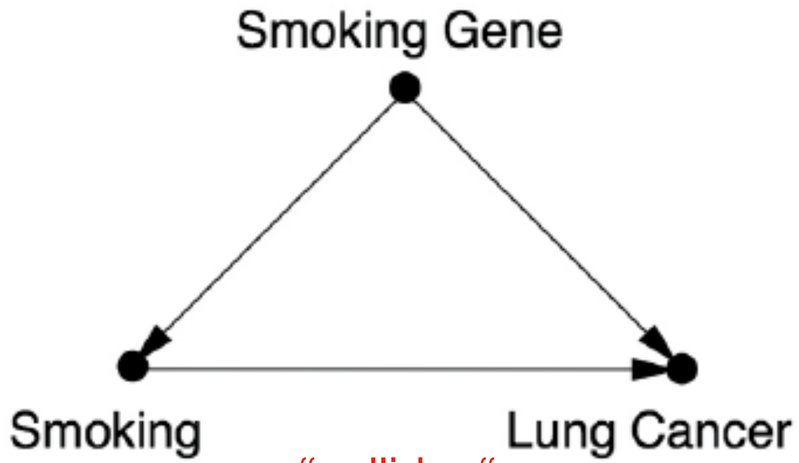
$$p(\text{overweight}, \text{smoking}, \text{heart disease}, \text{cough}) = p(\text{overweight}) \times f(\text{smoking}) \times p(\text{heart disease} \,|\, \text{overweight}, \text{smoking}) \times p(\text{cough} \,|\, \text{smoking}).$$

https://www.stat.cmu.edu/~larry/=sml/DAGs.pdf

Tool for thinking: The Causal Diagram

If you think you have a theory (explanation) for a phenomenon, you should express it as a **Causal Diagram**





"collider "

$$p(lc) = p(lc \mid s, g)p(s \mid g)p(g)$$

The causal diagram is not a final answer; it is a hypothesis !

It can get quite complicated, with external factors and **virtuous and vicious cycles**

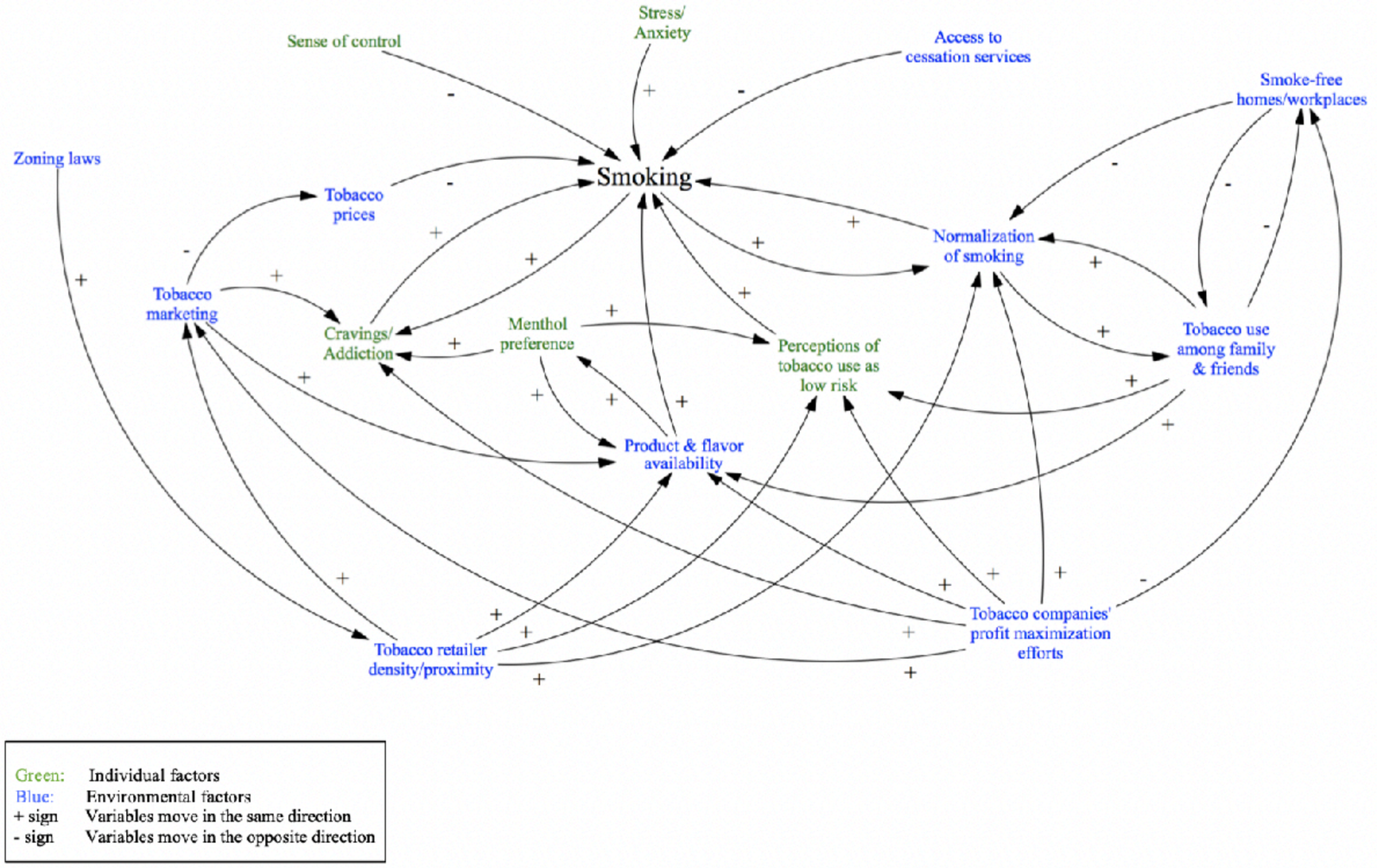


Figure 1 Initial causal loop diagram of smoking with individual and environmental factors.

Mills SD, *et al*. *Tob Control* 2021;**0**:1–9. doi:10.1136/tobaccocontrol-2021-056695

https://tobaccocontrol.bmj.com/content/tobaccocontrol/early/2021/09/16/tobaccocontrol-2021-056695.full.pdf

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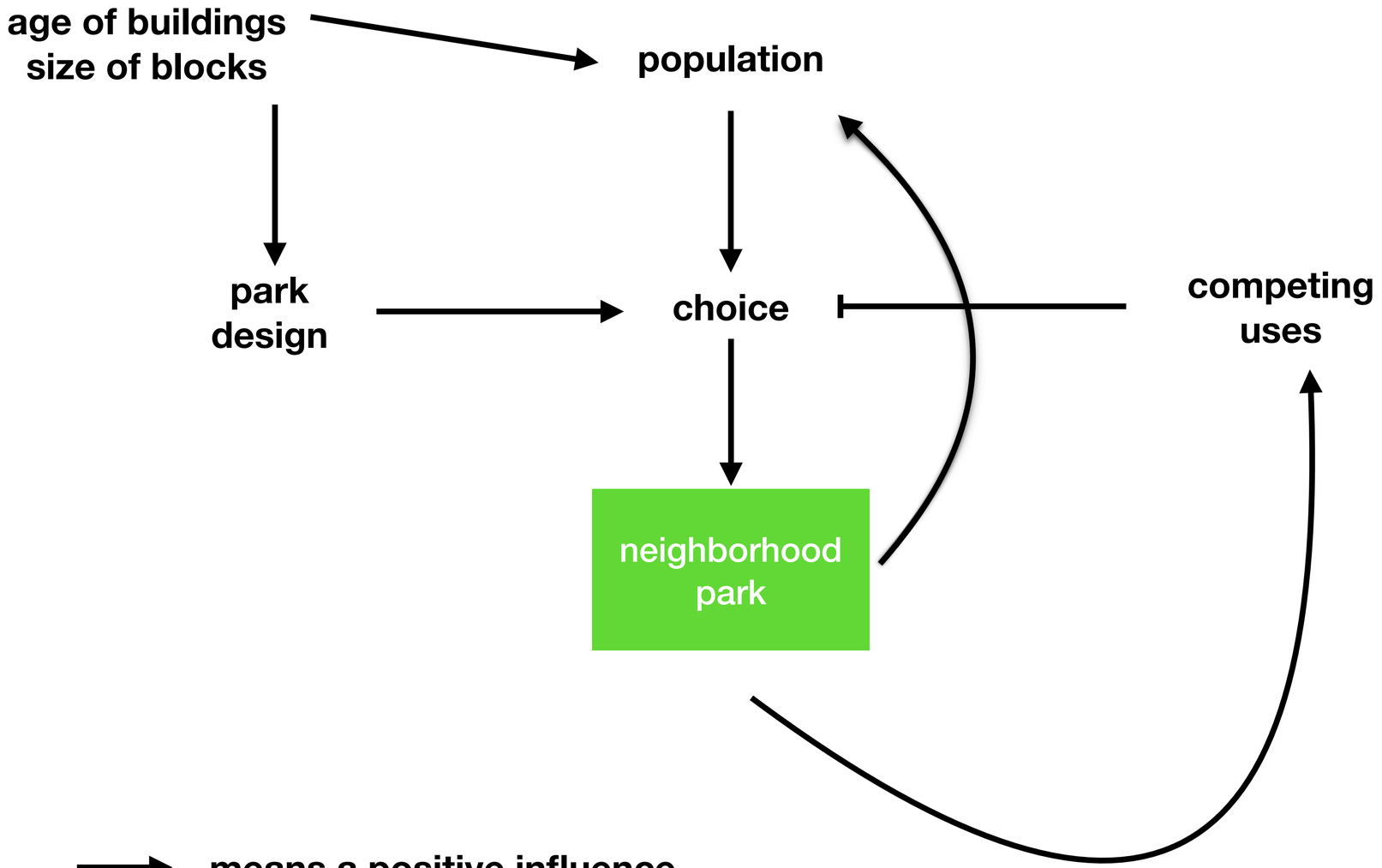


Your first assignment

means a positive influence

means a negative influence

The existence of loops in the diagram entails circular causality

Virtuous and vicious cycles calls for "policymaking in the loop”

How should we build a theory of cities?

“The kind of problem a city is”

J. Jacobs 1961: The death and life of great American cities, ch. 22

Ways of *scientific* thinking

Merely to think about cities and get somewhere, one of the main things to know is what kind of problem cities pose.

Which. avenues of thinking are apt to be useful and to help yield the truth depends not on -how we might prefer to think about a subject, but rather on the inherent nature of the subject itself.

Weaver’s Classification of Problems in Science

1. Simplicity
2. Disorganized complexity
3. Organized complexity → cities

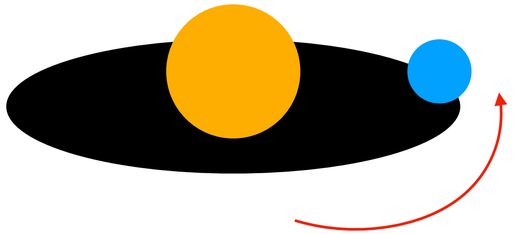
Jacobs

W. Weaver 1948 , Science and Complexity

https://www.jstor.org/stable/27826254

1. Simplicity

2 variables
clear case and effect
determinism



solar system

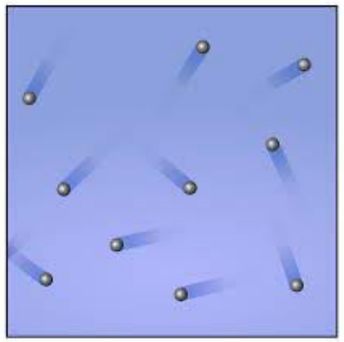
Examples: solar system, demand curve, representative agent u-maximization

2. Disorganized Complexity

large number of identical components

no history (do we care about history of a gas?)

ask only average questions (temperature, pressure,…)



credit: wikimedia commons

$\sim 10^{26}$

gas in a box

gases and liquids, telephone exchanges, insurance

3. Organized Complexity

today we call them: **complex adaptive systems**

or simply “Complex Systems”

They are all problems which involve dealing simultaneously with a sizable number of factors, which are interrelated into an organic whole

Although the interrelations of their many factors are complex, there is nothing accidental or irrational about the ways in which these factors affect each other.

We cannot even analyze the virtues and the faults, diagnose the trouble or consider helpful changes, without going at them as problems of “organized complexity”.

Diverse, interdependent agents
Connectivity structure
Information and Learning
Costs vs benefits
History

Jane Jacobs Proposed Strategy for Studying Cities:

"A growing number of people have begun, gradually, to think of cities as problems of *organized complexity* - organisms that are replete with unexamined, but obviously intricately interconnected, and surely understandable, relationships."

To understand Cities we should:

1. **Think about processes** — all science is based on processes, not static structures (=equilibria)
2. **Think inductively, from particulars to generals** — respect individuality, while seeking communality
3. **Seek "unaveraged" clues** — because information and diversity are washed out by averaging

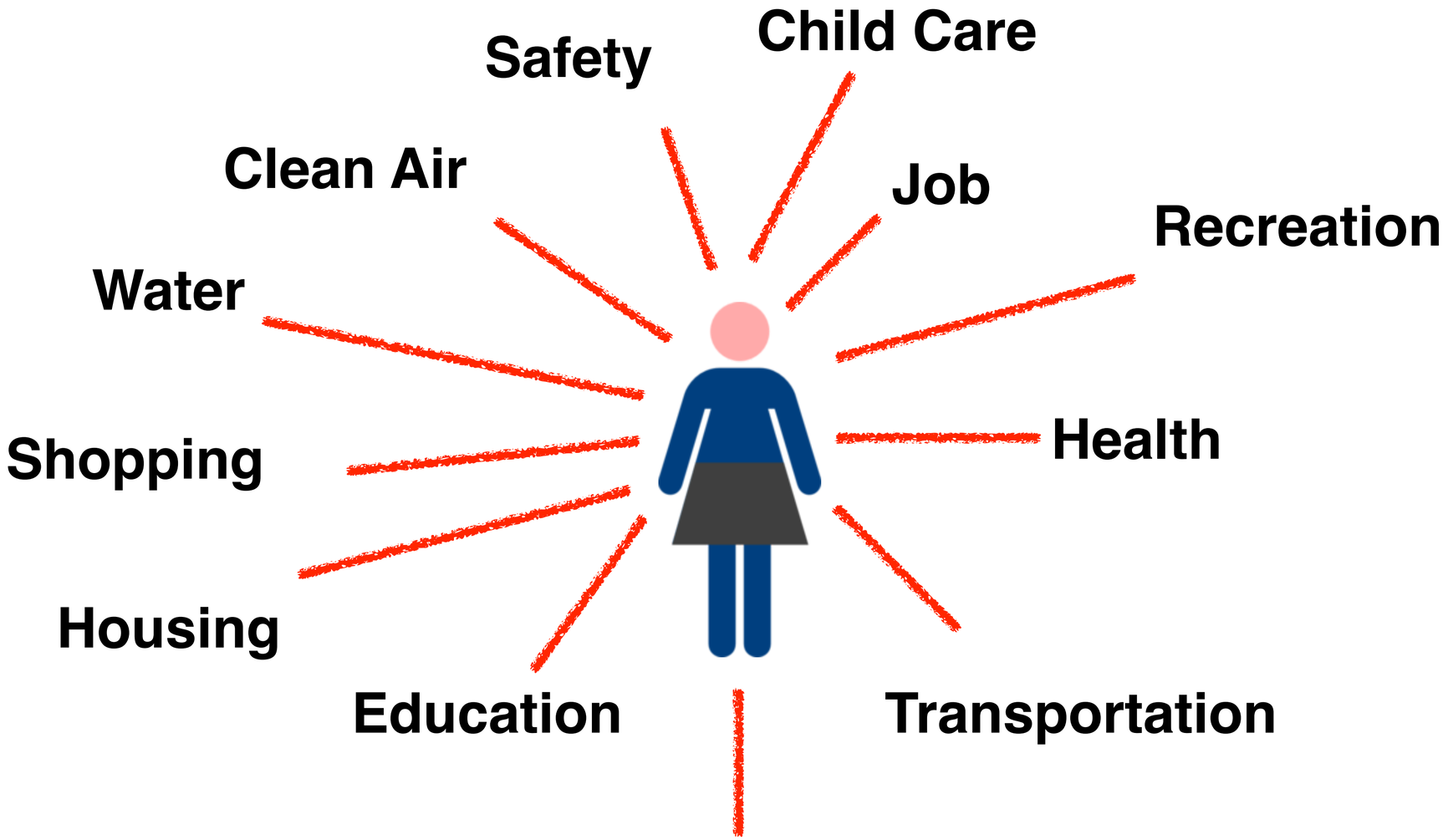
We will hold ourselves to these principles and will check in on them as we go.

Properties of Cities as Complex Systems

Heterogeneity	differences in information, profession, culture, race, ethnicity, economic status
Interconnectivity	interdependence and complementarities between people, organizations, infrastructure in networks
Scaling	self-similar economies of scale per capita in material infrastructure and increasing returns to socioeconomic activity
Circular-Causality	interdependence dynamics between socioeconomic activities, institutions and services
“Evolution”	open-ended change supported by new information, investment and collective action

We will keep an eye out for these properties in various approaches to cities and associated phenomena

The complex interconnected functions of cities are obvious from a person-centered perspective



Space + Time + Budgets + Capabilities → Quality of Life

“Organized Complexity”

Weaver, Jacobs, …

“Human Ecology”

Park, Burgess, **Urban Sociology**

Scale	Integration	Mechanism
10^9 billions 		
Individual		**cognition** **life-course** **human development** seeds of economic growth
	livability **safety** **education** **knowledge**	
10^6 millions 		**neighborhood effects** cumulative (dis)advantage sorting, inequality, environmental quality social justice
Neighborhood		
	selection **segregation** **mixing** **contagion**	
10^3 thousands 		**scaling laws and agglomeration** social + physical networks economy, information, land uses
City		
	migration **trade** **knowledge diffusion**	
10^0 one 		**laws of geography** gravity law, Zipf's law migration, urban hierarchy
Urban Systems		

All Scales Matter for Cities
but different problems at different scales