



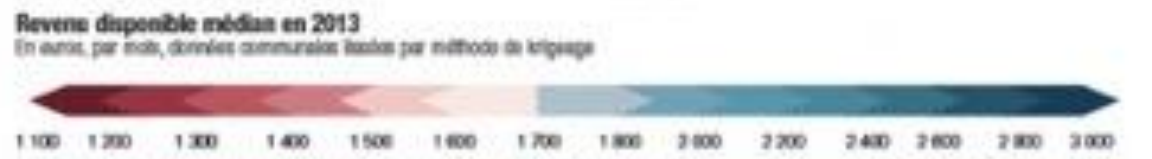
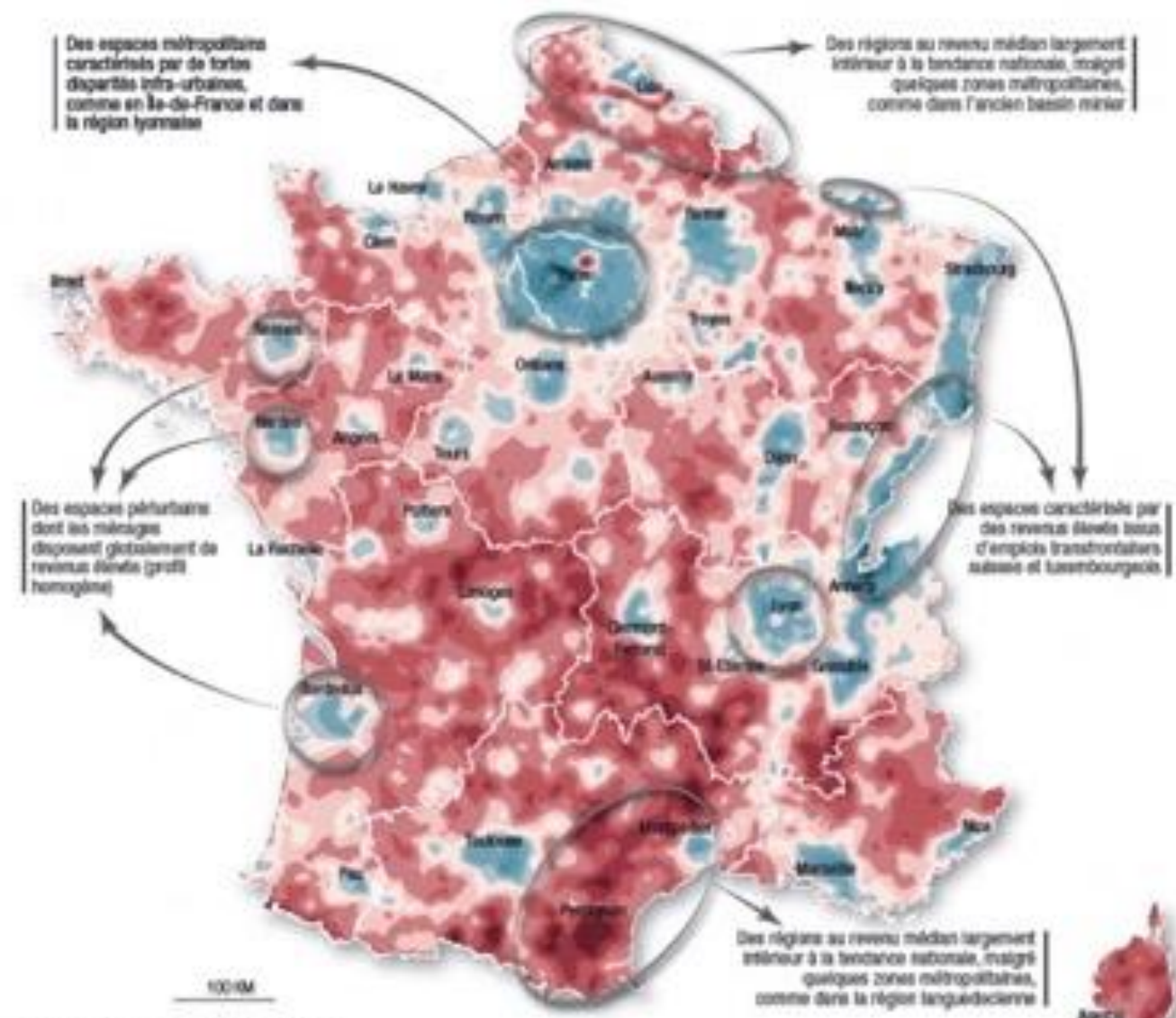
Institucionalidad (Urbano-Regional) Territorio e Infraestructuras

180626 Pedro B. Ortiz - Santiago de Chile



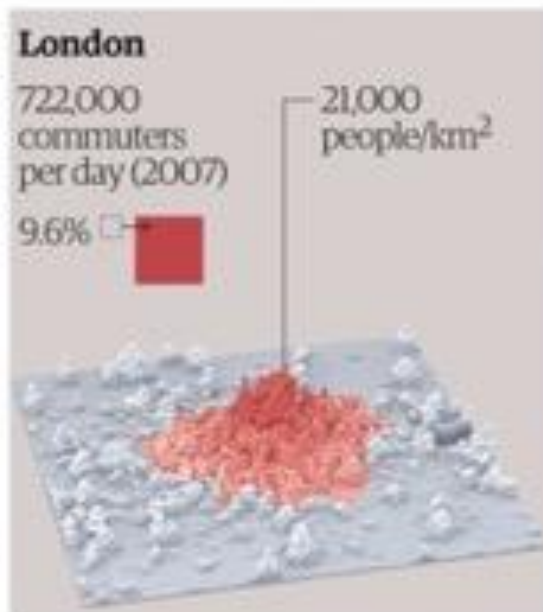
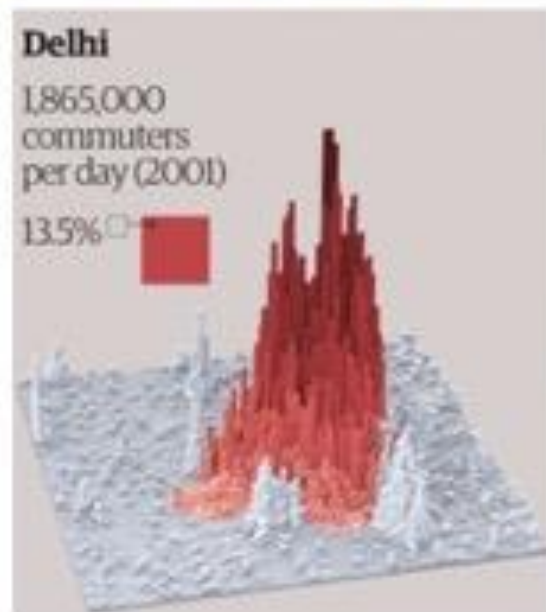
Santiago Metro-Matrix

- 1) Eficacia (Economía)
- 2) Integración (Gobernanza)
- 3) Inteligencia (Social)
- 4) Territorio (Físico)



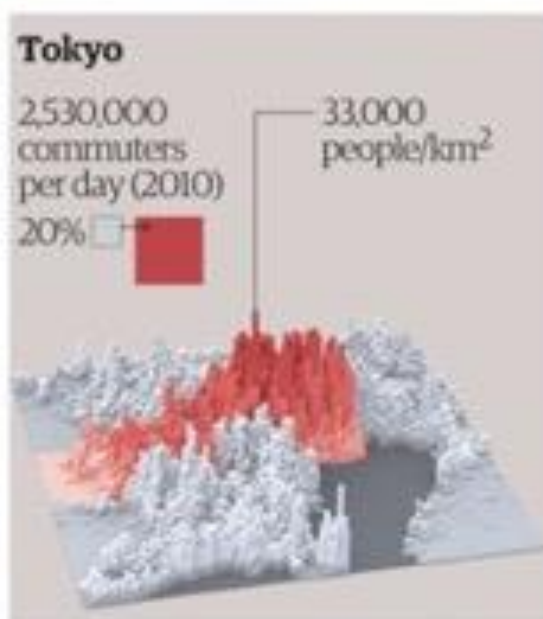
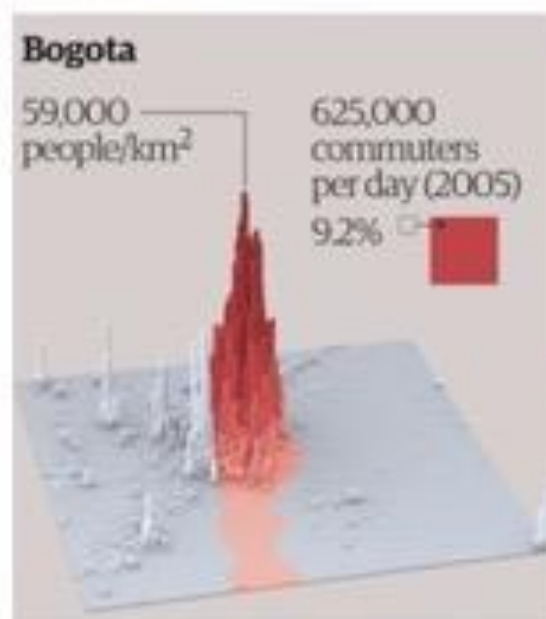
Measuring density

6.000 USD/Cap



153.000 USD/Cap

17.497 USD/Cap



43.664 USD/Cap

Rail and bus rapid transit (BRT) infrastructure

■ National level ■ State level ■ City level ■ Private sector
■ Outside boundary / data unavailable ■ Shared responsibility

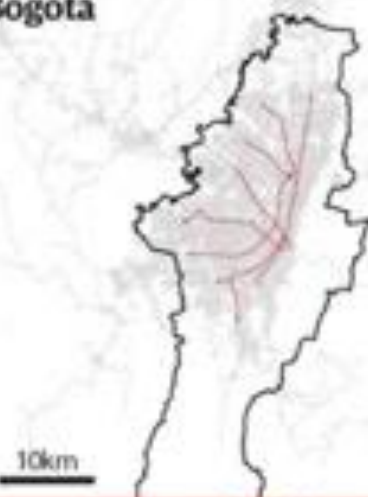
Delhi



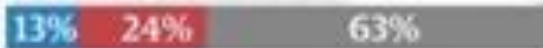
London

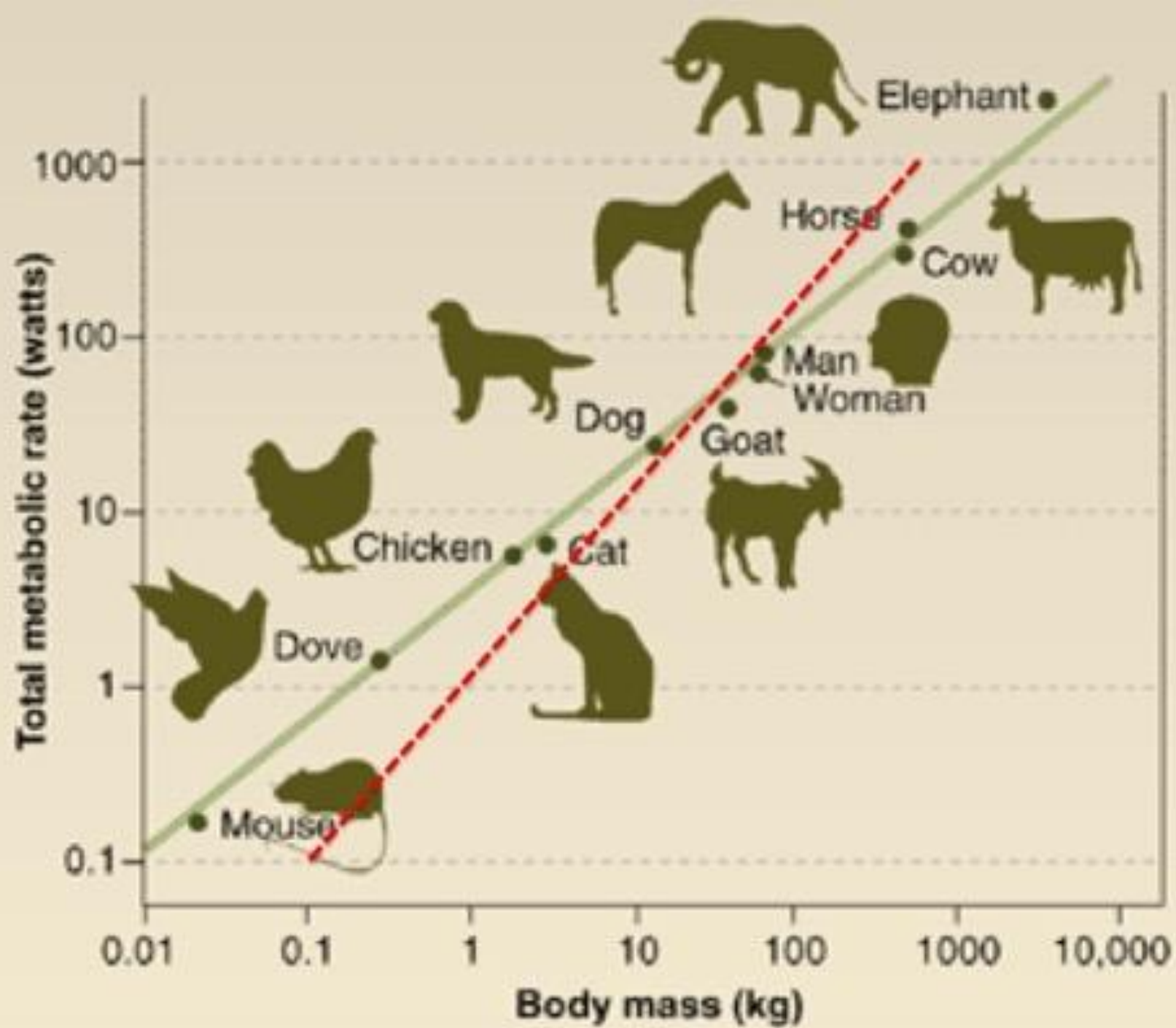


Bogota

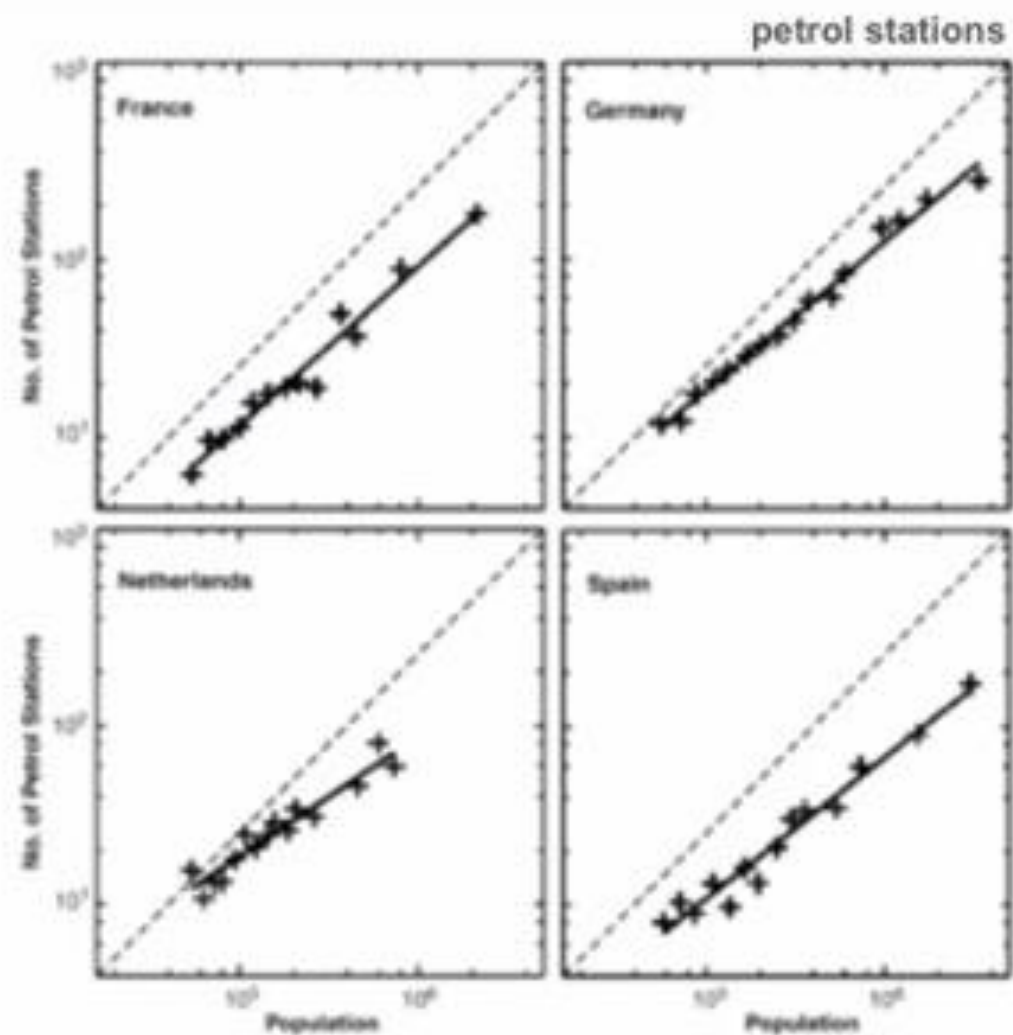


Tokyo





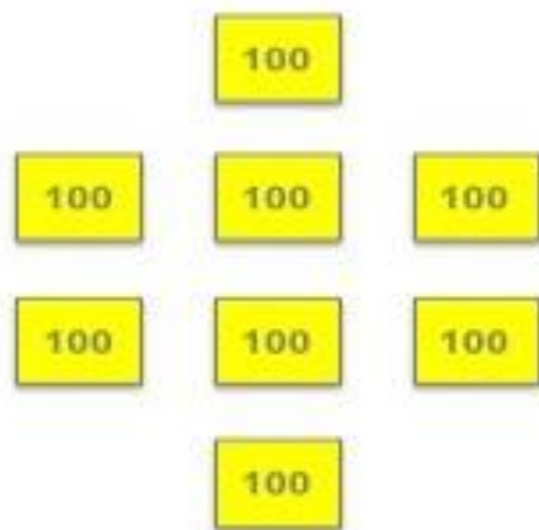
Facilities



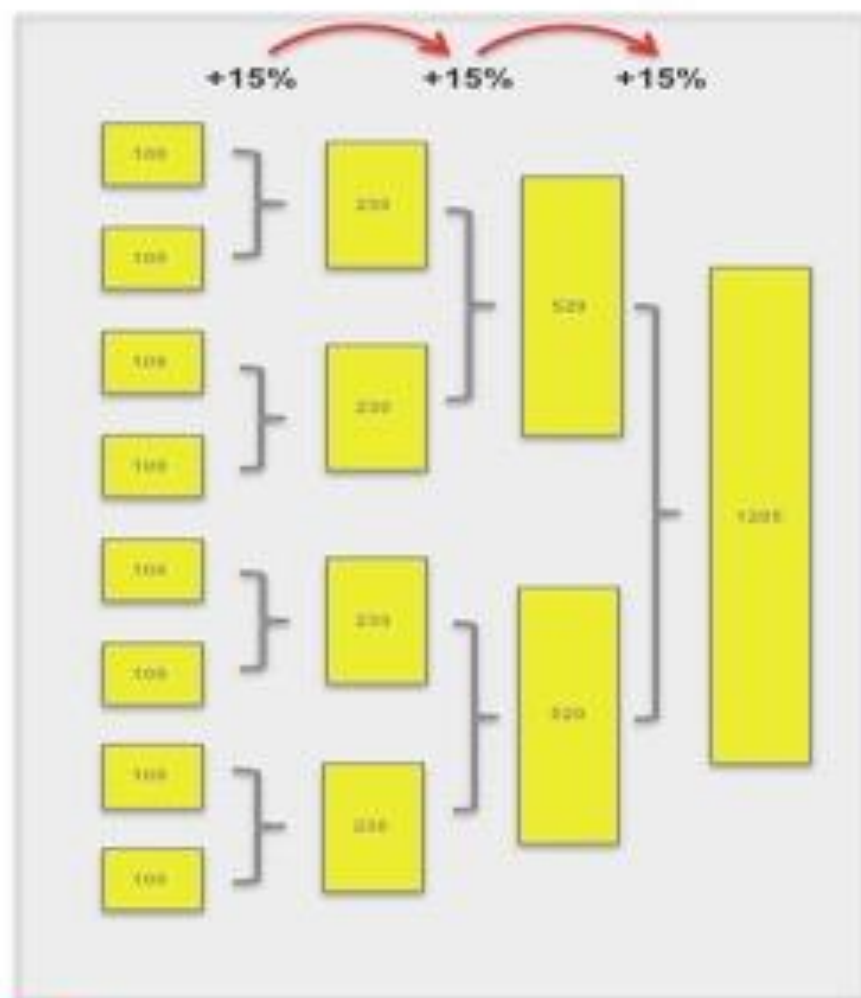
Kuhnert, Helbing & West, Physica A363, 96-103 (2003)

The efficiency impact of metro transport from the 15% rule

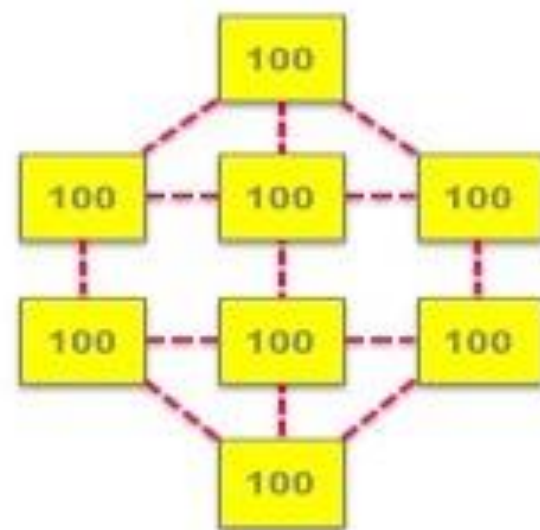
No transport:
Disjointed action



$$\Sigma = 800$$



Metropolitan transport:
Multiplier effect



$$\Sigma = 1295$$

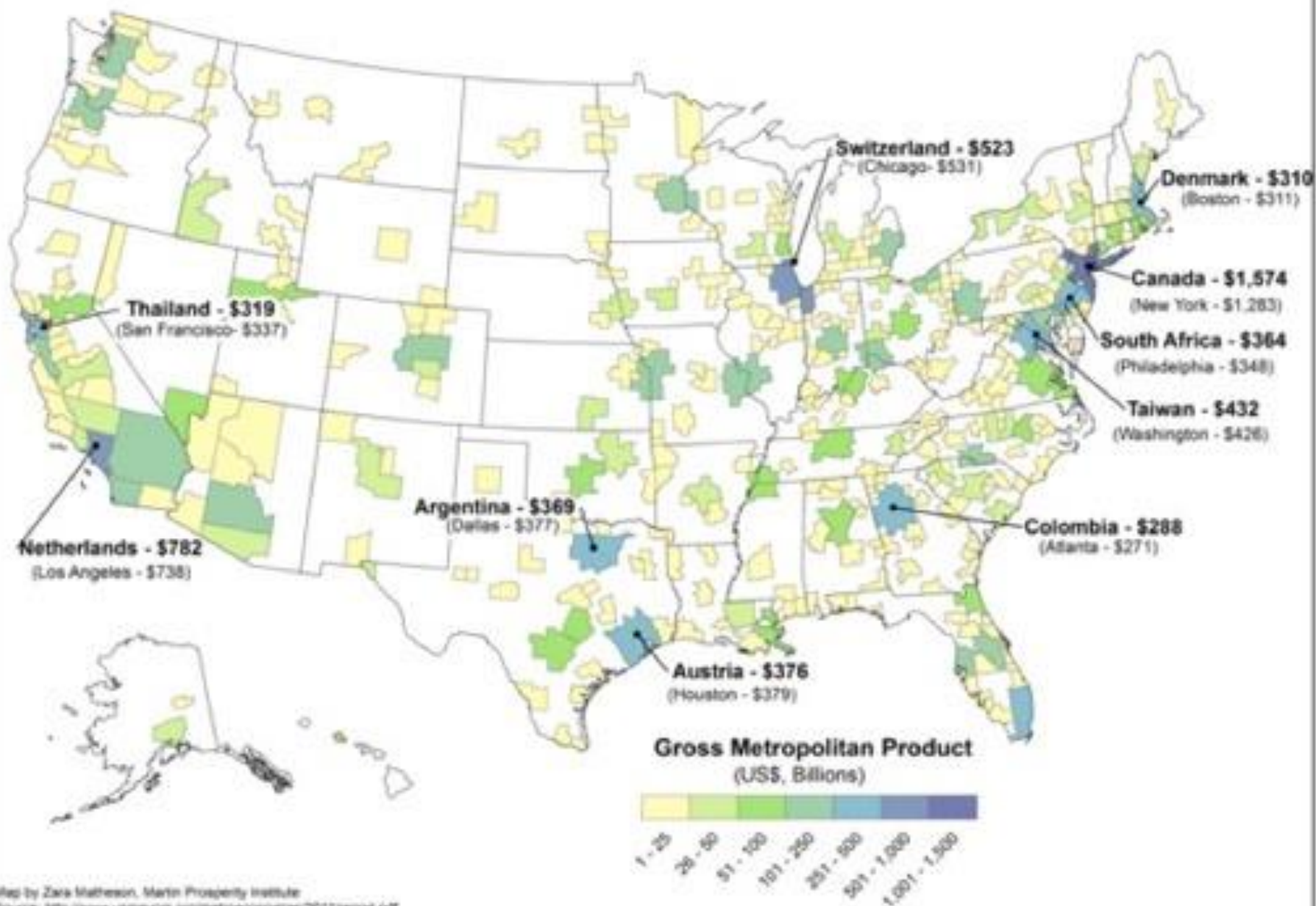
+ 62%

Effect of Metropolitan Transport:

A disjointed metropolis with 8 unconnected municipalities produces 800

If connected in a single polycentric metropolitan system by transport they will produce 1295: 62% more

Countries & US Metros: Nearest GDP Equivalents



The United Metro/Nations

Among the top 100, 45 metros



	GDP in US Billions	(% of National (Σ = Sum of largest))			
0 Europe (Confederation)	18495		34 Washington DC	\$ 433	(Σ 21%)
1 United States	15094		35 Houston	\$ 420	(Σ 24%)
2 China	7298		36 Osaka Japan	\$ 417	(Σ 33%)
3 Japan	5869		37 Austria	417	
4 Germany	3569		38 South Africa	408	
5 France	2774		39 Dallas-F. Worth USA	\$ 401	(Σ 27%)
6 Brazil	2476		40 Mexico City Mexico	\$ 390	(33%)
7 United Kingdom	2416		41 Sao Paulo Brazil	\$ 390	(15%)
8 Italy	2198		42 Philadelphia USA	\$ 388	(Σ 30%)
9 India	1897		43 United Arab Emirates	371	
10 Russia	1857		44 Boston USA	\$ 363	(Σ 32%)
11 Canada	1739		45 Buenos Aires Argentina	\$ 362	(80%)
12 Spain	1492		46 Thailand	345	
13 Australia	1483		47 Denmark	333	
14 Tokyo Japan	\$ 1479	(25%)	48 Colombia	333	
15 New York USA	\$ 1406	(10%)	49 Moscow Russia	\$ 321	(17%)
16 Mexico	1154		50 Hong Kong Hong Kong	\$ 320	(100%)
17 South Korea	1116		51 Venezuela	317	
18 Indonesia	846		52 Madrid Spain	\$ 308	(20%)
19 Netherlands	837		53 Atlanta USA	\$ 304	(Σ 34%)
20 Los Angeles USA	\$ 792	(Σ 15%)	54 San Francisco USA	\$ 301	(Σ 36%)
21 Turkey	773		55 Greece	299	
22 Switzerland	637		56 Miami USA	\$ 292	(Σ 38%)
23 Saudi Arabia	576		57 Seoul South Korea	\$ 291	(26%)
24 Chicago USA	\$ 574	(Σ 18%)	58 Malaysia	278	
25 London UK	\$ 565	(23%)	59 Nigeria	272	
26 Paris France	\$ 564	(20%)	60 Finland	266	
27 Sweden	537		61 Singapore	\$ 259	(100%)
28 Poland	514		62 Toronto Canada	\$ 253	(15%)
29 Belgium	512		63 Detroit USA	\$ 253	(Σ 40%)
30 Iran	499		64 Israel	243	
31 Norway	485		65 Portugal	237	
32 Taiwan	467		66 Seattle USA	\$ 235	(Σ 41%)
33 Argentina	446		67 Chile	234	
			68 Shanghai China	\$ 233	(3%)
			69 Egypt	230	
			70 Philippines	224	
			71 Frankfurt Germany	\$ 221	(6%)
			72 Ireland	217	
			73 Algeria	217	
			74 Czech Republic	215	
			75 Sydney Australia	\$ 213	(15%)
			76 Mumbai India	\$ 209	(11%)
			77 Pakistan	209	
			78 Rio de Janeiro Brazil	\$ 208	(Σ 25%)
			79 Phoenix USA	\$ 200	(Σ 43%)
			80 Iraq?	195	
			81 Minneapolis USA	\$ 194	(Σ 45%)
			82 San Diego USA	\$ 191	(Σ 46%)
			83 Romania	189	
			84 Kazakhstan	186	
			85 Istanbul Turkey	\$ 182	(24%)
			86 Barcelona Spain	\$ 177	(Σ 32%)
			87 Peru	176	
			88 Melbourne (Australia)	\$ 173	(Σ 26%)
			89 Qatar	173	
			90 New Delhi India	\$ 167	(Σ 20%)
			91 Beijing China	\$ 166	(Σ 5%)
			92 Denver USA	\$ 165	(Σ 47%)
			93 Ukraine	165	
			94 New Zealand	161	
			95 Kuwait	156	
			96 Manila Philippines	\$ 149	(66%)
			97 Montreal Canada	\$ 148	(Σ 23%)
			98 Cairo Egypt	\$ 145	(63%)
			99 Rome Italy	\$ 144	(6.5%)
			100 Guangzhou, China	\$ 143	(Σ 7.5%)

Chile map of Köppen climate classification



	Población	PIB	PIB/Cap
Santiago	7 m	101 b	14.500 USD
Chile	18 m.	234 b	13.000
Chile - Santiago			12.000 USD
Proporción S/Ch	30%	43%	+20%

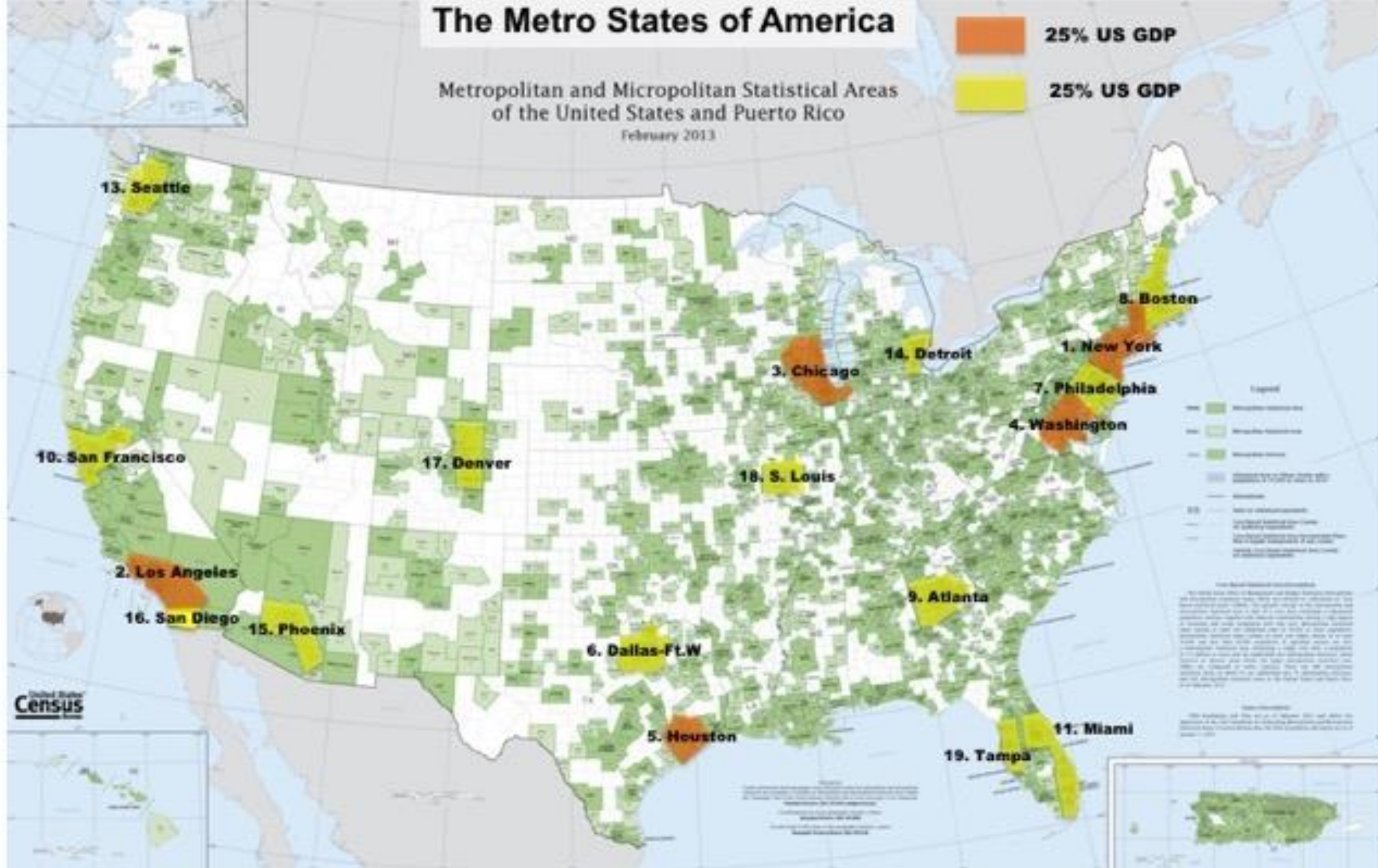
The Metro States of America

Metropolitan and Micropolitan Statistical Areas
of the United States and Puerto Rico

February 2013

25% US GDP

25% US GDP





United Metro-Nations

Physical Component
Objective: Sustainability
Sectors of planning

Discontinuous Systems

Productive Activities

- Industry
- Offices
- Commerce

Housing

- Density
- Typology/Program
- Accessibility
- Price/Finance

Social Facilities

- Health
- Education
- Sports
- Leisure
- Gender
- Young
- Old
- Culture

Continuous Systems

Transport

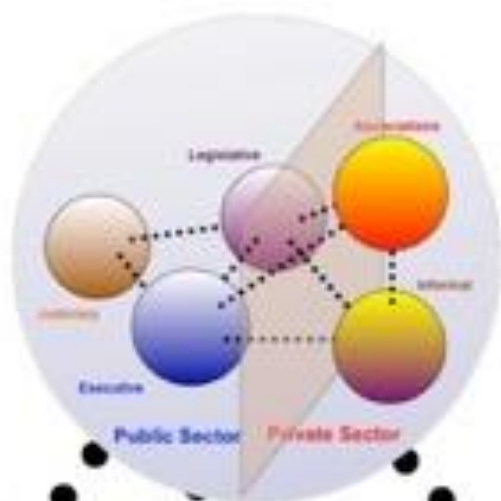
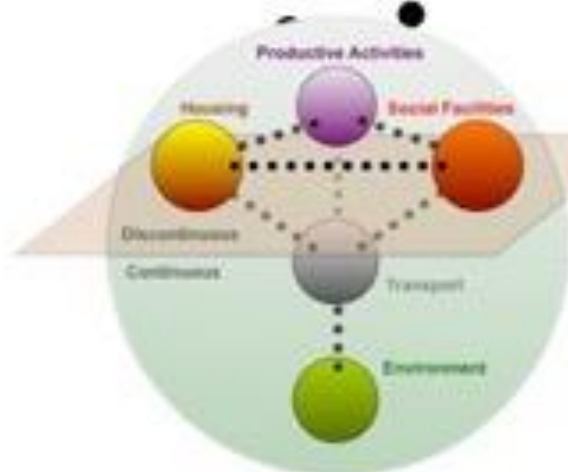
- Gray Infrastructure
- Rail
 - Road
 - Pipes
 - Wires
 - Intangible

Environment

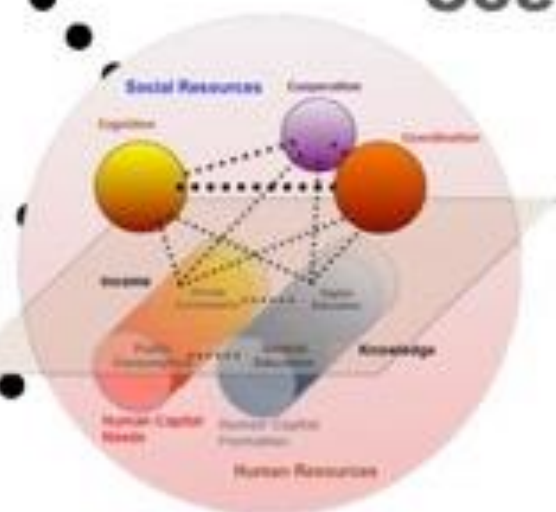
- Green Infrastructure
- Ecosystems
 - Waterways
 - Biodiversity transfers

The Genoma

Economic



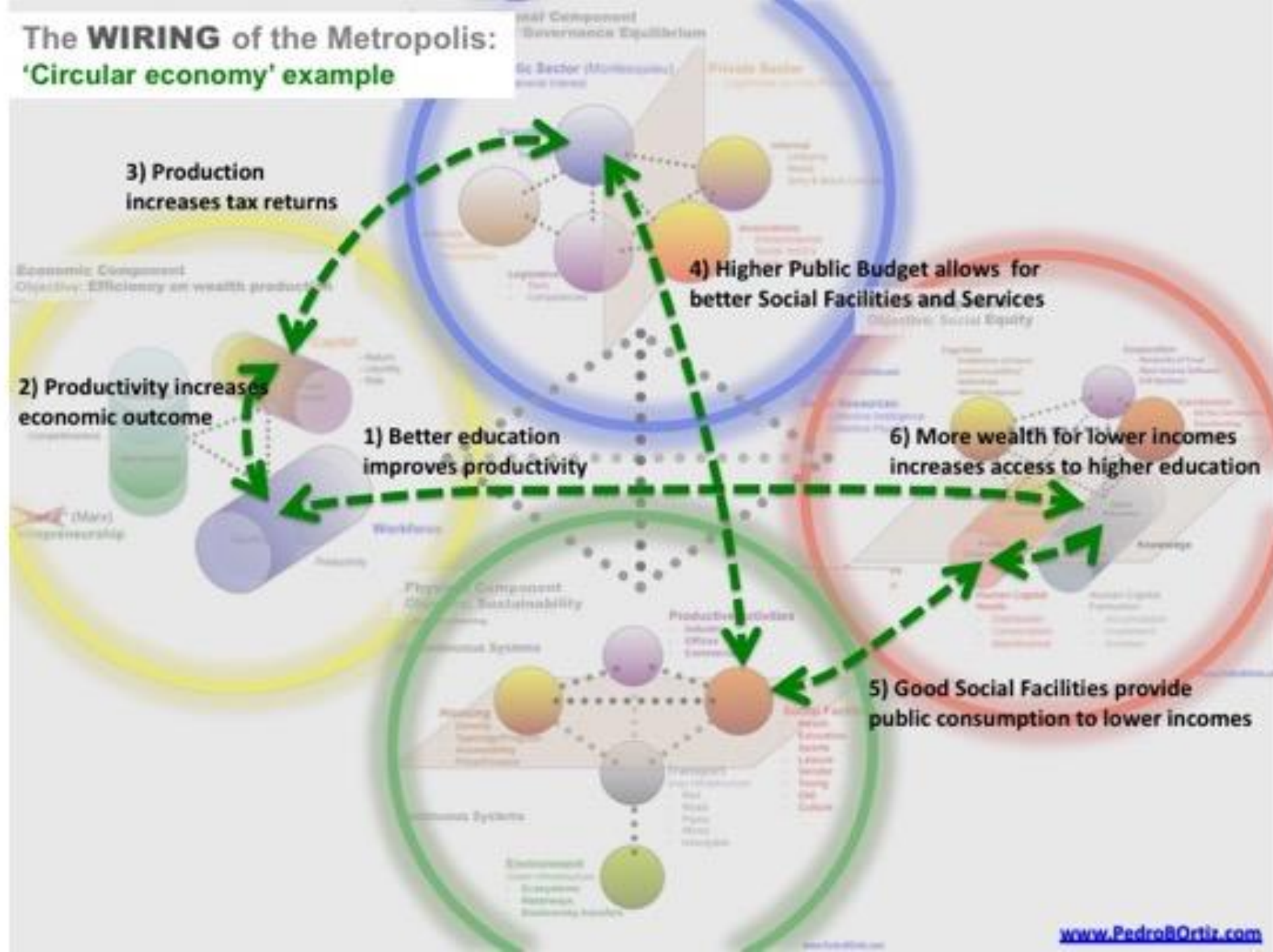
Governance



Social

Physical Environment

The **WIRING** of the Metropolis:
'Circular economy' example



La
Estructura Institucional

refleja la

Inteligencia Colectiva

de un Pueblo

Definición:

**La Inteligencia Colectiva es cuando
2 personas trabajando juntas
producen **2.5** en lugar de 2.**

Corolario:

**la Estupidez es cuando producen 1.5, y la
Estulticia colectiva es cuando producen 0.5.**

**Nota: El funcionamiento de las Instituciones y el PIB
son buenos indicadores de esa Inteligencia Colectiva**

Collective Intelligence: double non-integrated theories

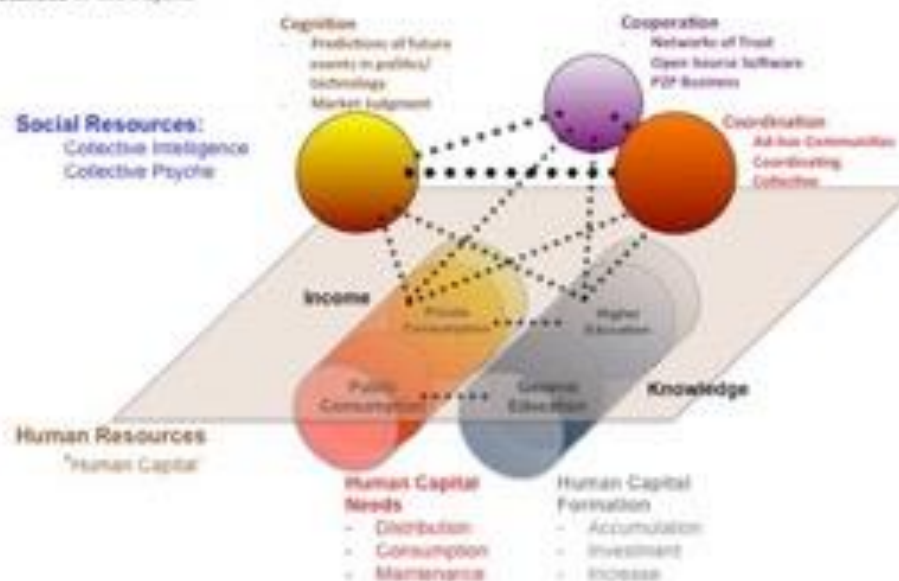
Empiricism

Versus

Neo-Platonism

(Max Plank paradox of theories of light both wave and corpuscular)

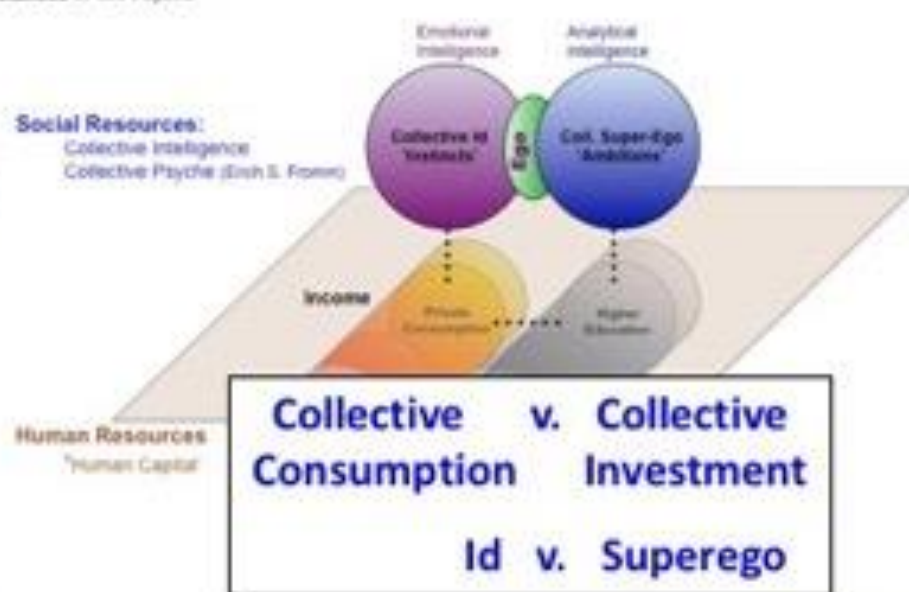
Social Component
Objective: Social Equity
Instances of the Psyche



www.Psychoforum.com

Chicago School
'Mosaic'
New School NY

Social Component
Objective: Social Equity
Instances of the Psyche



www.Psychoforum.com

Vienna School
'Gestalt'

Metropolitan Scale

Spatial Scales and Disciplinary approach

	Scale	Discipline	Knowledge areas
	1: 50.000.000	Geopolitics	UN. NATO. US. EU. IMF, OPEP,
	1: 5.000.000	'Regional' (Continental) Politics	UN. OAS. WB. BID. ADB. AFDB.
	1: 500.000	National Development	Politics, Economics, Sociology, Environment, Geography
	1: 50.000	Metropolitan Planning	Economics, Sociology, Infrastructure, Environment, Utilities
	1: 5.000	Urban Planning	Housing, Industrial, Services, Commerce, Transport, Environment
	1: 500	Urban design	Space, Volume, Semiotics, Engineering,
	1: 50	Architecture	Light, Space, Texture, Materials, Structure, Installations, Budget

Worm



Snake



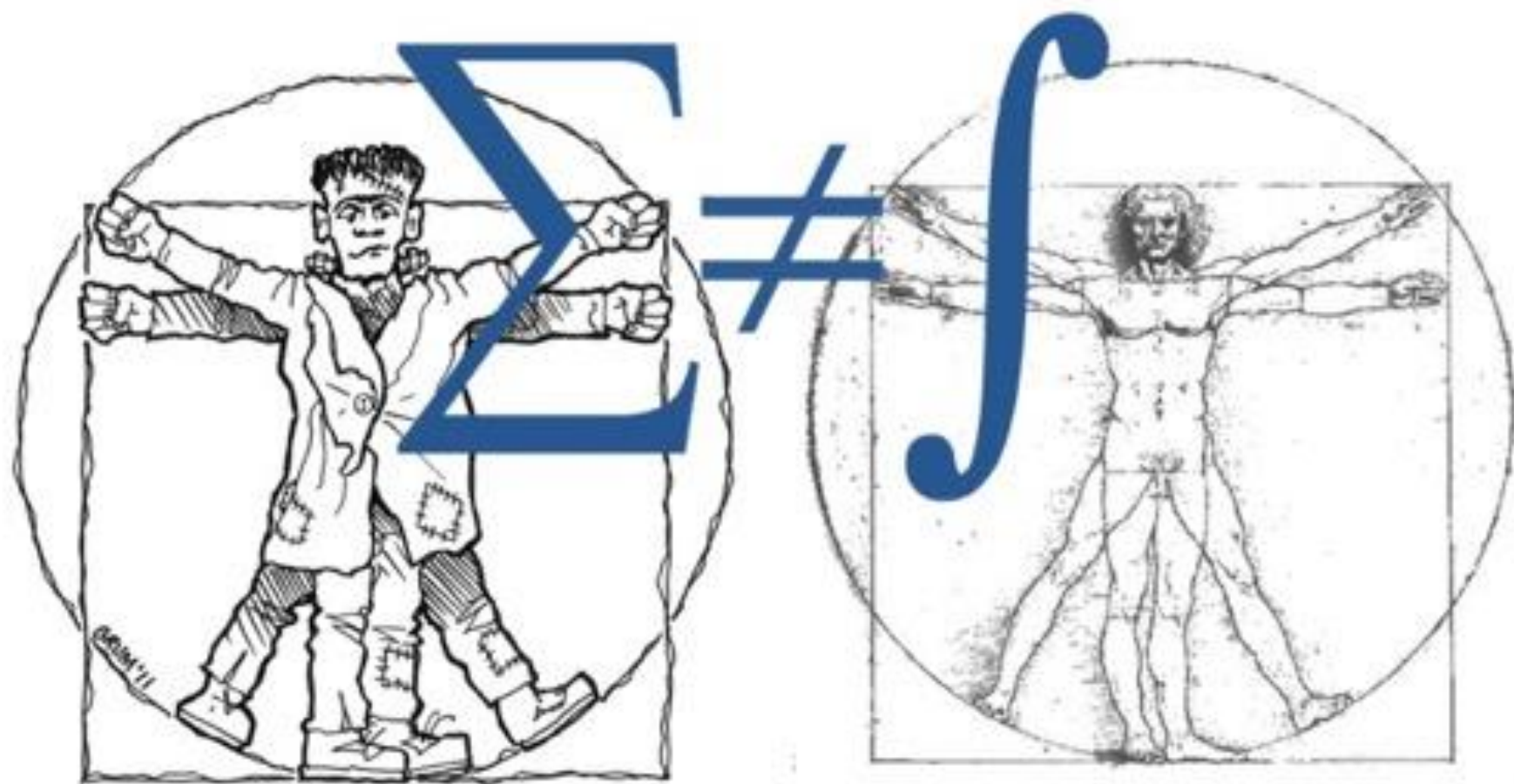
Helminology

Urbanism

Ophisology

Metropology

Metropolises are not aggregation of municipalities. They are an entity on their own



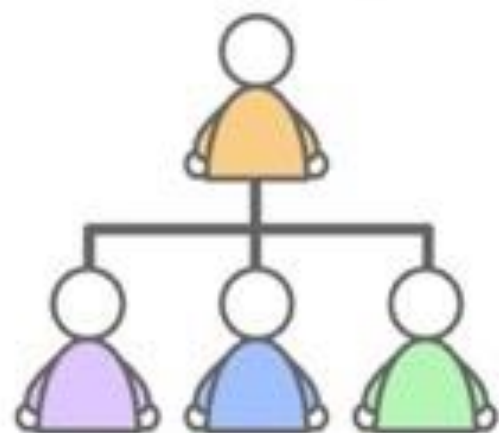
Aggregative = Summation

Synthesis = Integral

TERRITORIAL GOVERNANCE

City Hierarchical/Orbital Governance

Citizens/Municipality Dialogue



Metropolitan Matrix Governance

Inter/administrative Dialogue

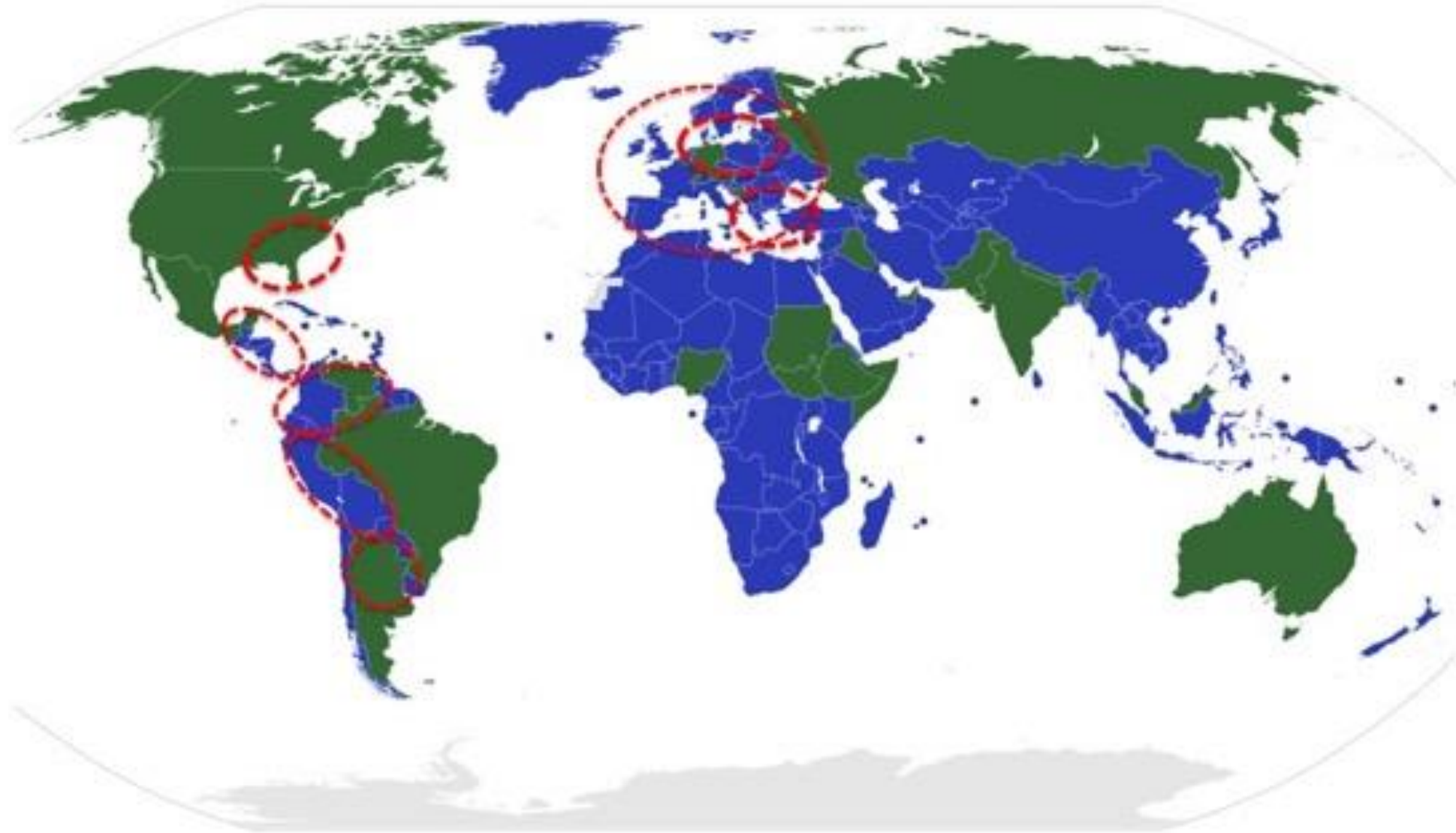


A 6x6 matrix grid illustrating Metropolitan Matrix Governance. The grid is composed of 6 rows and 6 columns. Each cell contains either a person icon or a colored circle. The icons in the top row are orange, red, pink, yellow, blue, and blue. The circles in the grid are colored yellow, blue, red, grey, red, blue, green, red, blue, grey, blue, green, green, blue, red, grey, yellow, red, and grey.

	Orange	Red	Pink	Yellow	Blue	Blue
Orange		Yellow		Grey	Red	Green
Red	Yellow		Blue	Red		Yellow
Pink	Red				Blue	Grey
Yellow	Grey	Yellow	Green		Red	Blue
Blue	Green	Blue	Red	Grey		Green
Blue	Grey	Green		Yellow	Red	

NATIONAL STATES GOVERNANCE

Unitary - **Federal** - **Confederal**



Main Metropolis as % of National GDP

(... and political significance)

60%



**Egypt,
Philippines,
Argentina...**

**Unitary
Decentralized**

30%

**France,
England,
Spain...**

5%

**Germany,
Italy,
China,
USA...**

Federal

NATIONAL-STATES GOVERNANCE SYSTEMS

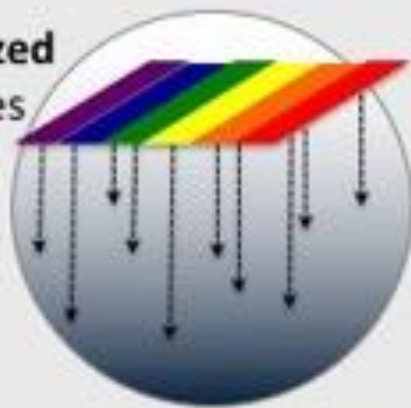
Confederal

Sovereign
unit/states

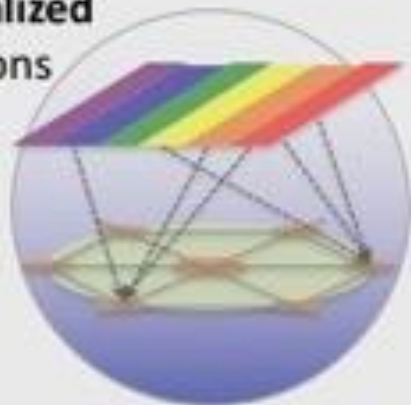


Unitary

Centralized
Ministries



Decentralized
Delegations



Federal

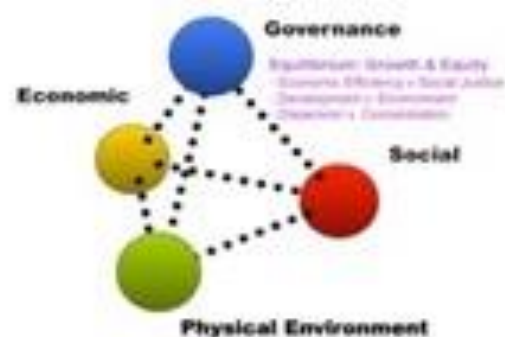
Sovereign
Federal Union



States

Unitary Decentralized

GOBERNANZA METROPOLITANA



Confederación Municipal

- | | |
|------------------------|-----------|
| 1) Mesa de diálogo | Compartir |
| 2) Proyectos paralelos | Coordinar |
| 3) Proyecto Común | Conjuntar |
| 4) Agencia Gestora | Unir |
-

- | | |
|----------------------|----------------|
| 5) Unitario Delegado | Descentralizar |
| 6) Unitario | Centralizar |

Gobierno central

- | | |
|--------------------|-----------|
| 7) Naciones Unidas | Conjuntar |
|--------------------|-----------|

GOBERNANZA METROPOLITANA



- | | |
|------------------------|-----------|
| 1) Mesa de diálogo | Compartir |
| 2) Proyectos paralelos | Coordinar |
| 3) Proyecto Común | Conjuntar |
| 4) Agencia Gestora | Unir |

Confederación Municipal

-
- | | |
|---------------------------|------------|
| 5) Organismo Funcional | Especifica |
| 6) Gobierno Metropolitano | Federal |

Metrópolis Federal

-
- | | |
|----------------------|----------------|
| 7) Unitario Delegado | Descentralizar |
| 8) Unitario | Centralizar |

Gobierno central

- | | |
|--------------------|-----------|
| 9) Naciones Unidas | Conjuntar |
|--------------------|-----------|

GOBERNANZA METROPOLITANA

- | | |
|------------------------|-----------|
| 1) Mesa de diálogo | Compartir |
| 2) Proyectos paralelos | Coordinar |
| 3) Proyecto Común | Conjuntar |
| 4) Agencia Gestora | Unir |

-
- | | |
|---------------------------|------------|
| 5) Organismo Funcional | Especifica |
| 6) Gobierno Metropolitano | Federal |

-
- | | |
|----------------------|----------------|
| 7) Unitario Delegado | Descentralizar |
| 8) Unitario | Centralizar |

- | | |
|--------------------|-----------|
| 9) Naciones Unidas | Conjuntar |
|--------------------|-----------|



Confederación Municipal



Metrópolis Federal



Gobierno central

GOBERNANZA METROPOLITANA



- | | |
|------------------------|-----------|
| 1) Mesa de diálogo | Compartir |
| 2) Proyectos paralelos | Coordinar |
| 3) Proyecto Común | Conjuntar |
| 4) Agencia Gestora | Unir |

Confederación Municipal



-
- | | |
|---------------------------|------------|
| 5) Organismo Funcional | Especifica |
| 6) Gobierno Metropolitano | Federal |

Metrópolis Federal



-
- | | |
|----------------------|----------------|
| 7) Unitario Delegado | Descentralizar |
| 8) Unitario | Centralizar |

Gobierno central

- | | |
|--------------------|-----------|
| 9) Naciones Unidas | Conjuntar |
|--------------------|-----------|

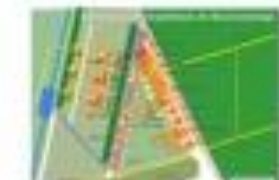
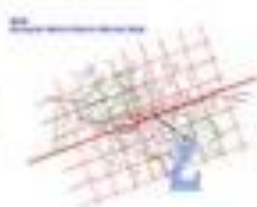
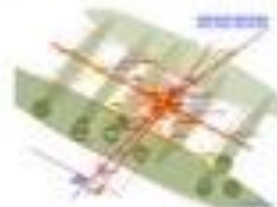


Metropolitan Brainshops

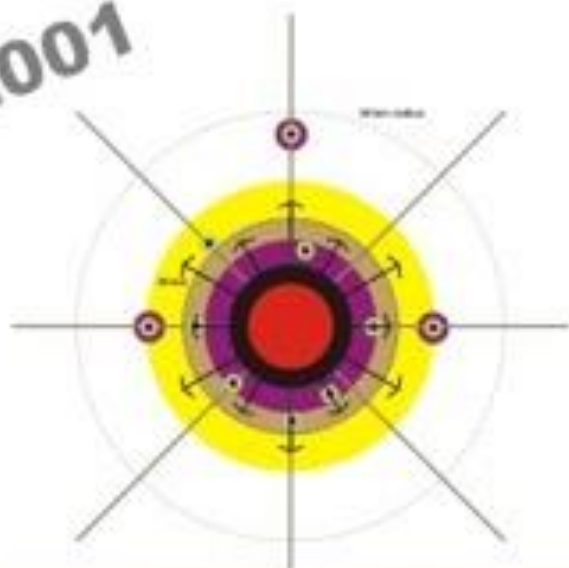


THE WORLD BANK

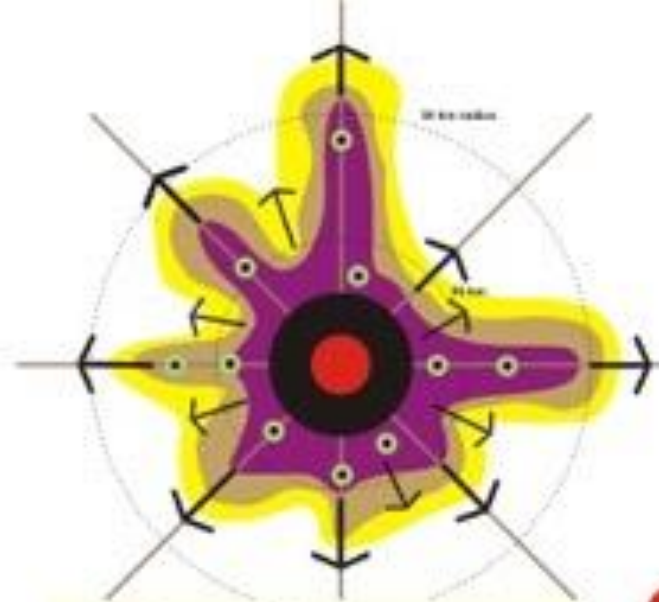
UN HABITAT
FOR A BETTER URBAN FUTURE



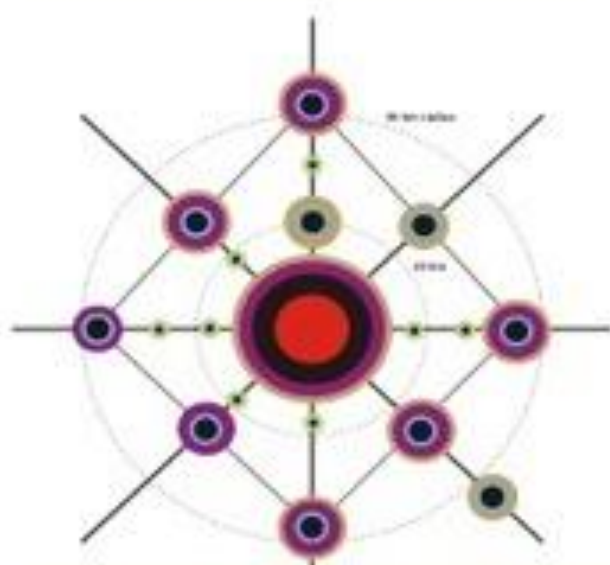
2001



Monocentric Structure



Sprawl Structure



Polycentric Structure



Multipolar Structure

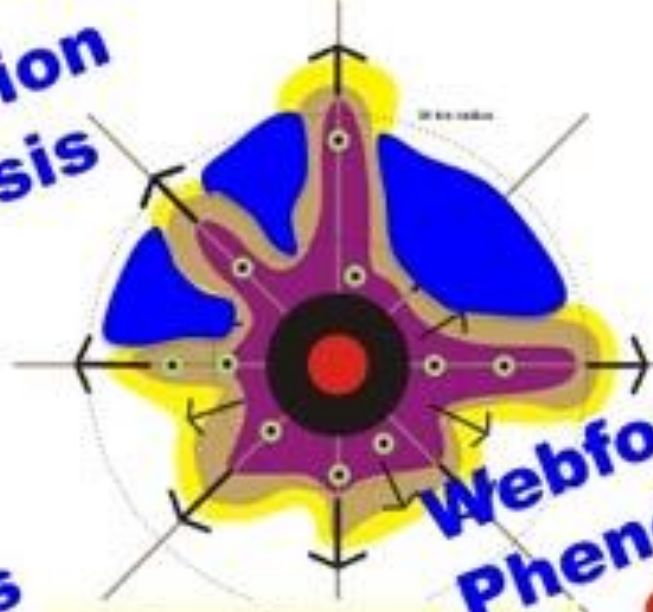
- Metropolitan Core
- Outer Core
- Major Inter-city Road
- Principal Metropolitan Sub-Center
- Secondary Metropolitan Sub-Center
- High Density Suburban
- Medium Density Suburban
- Low Density Suburban

2016



Monocentric Structure

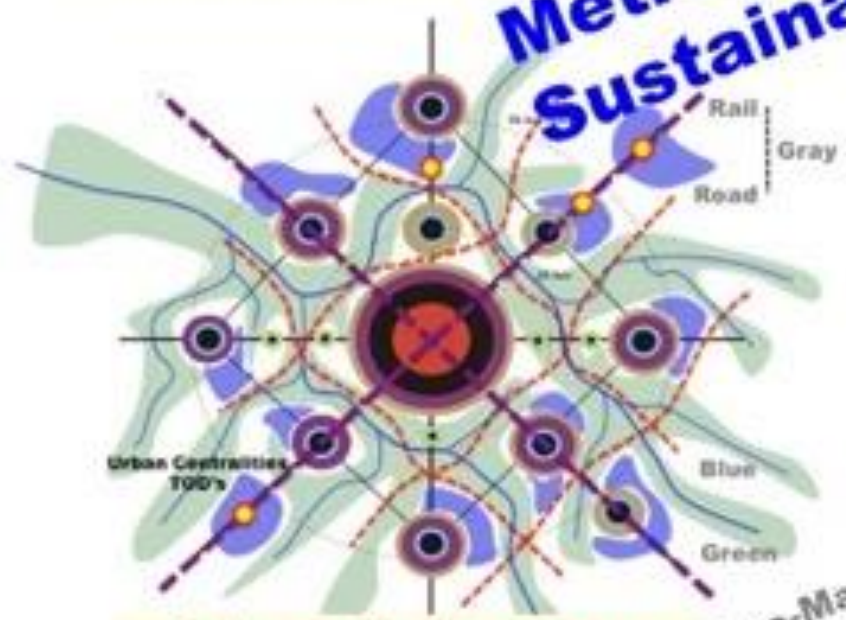
**Conurbation
Metastasis**



Sprawl Structure

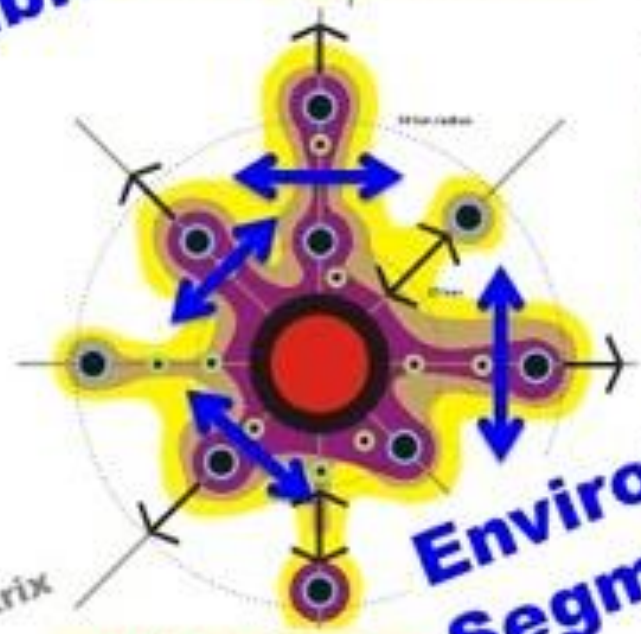
**Webfoot
Phenomenon**

**Metropolis
Sustainable**



Polycentric Structure

Metro-Matrix

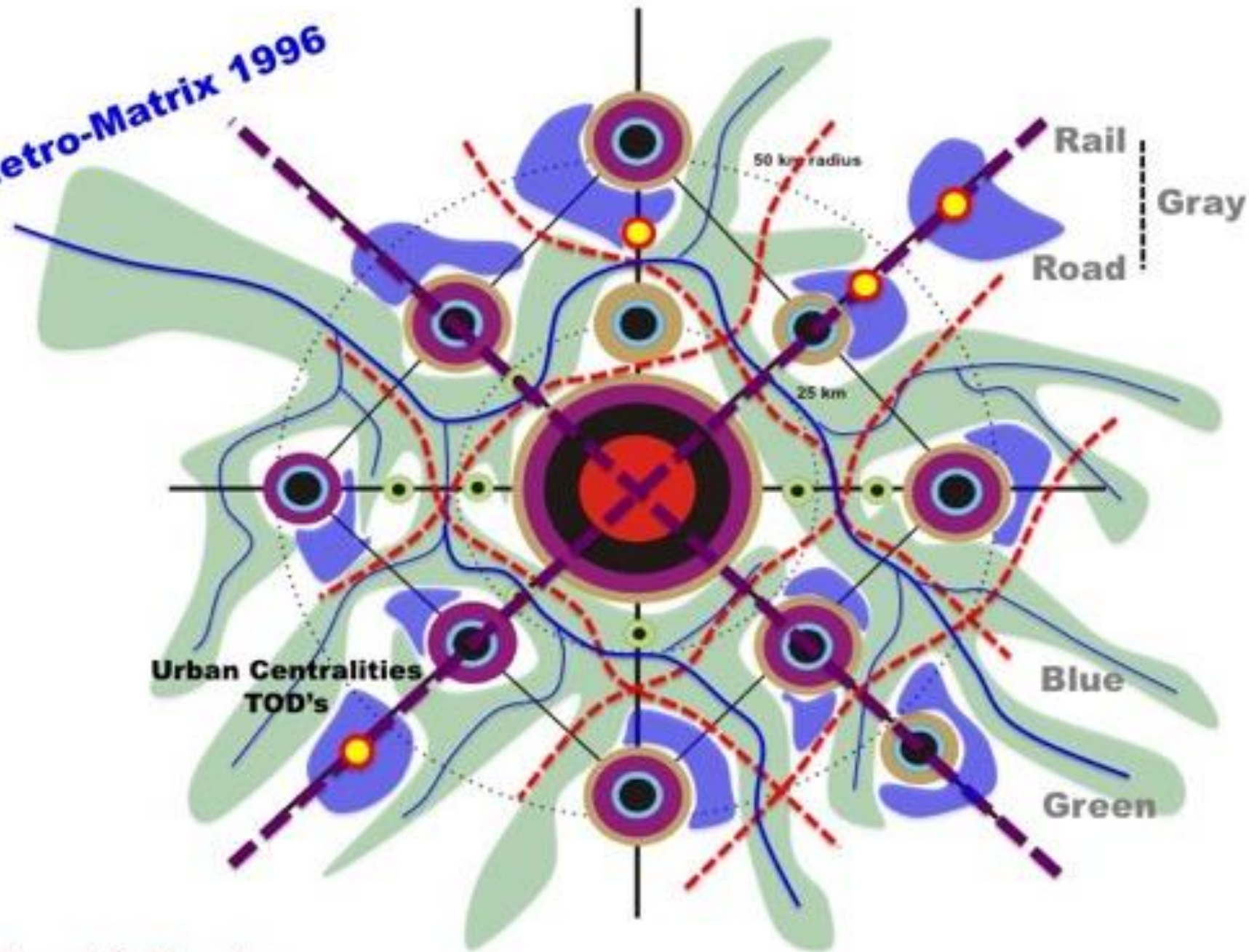


Multipolar Structure

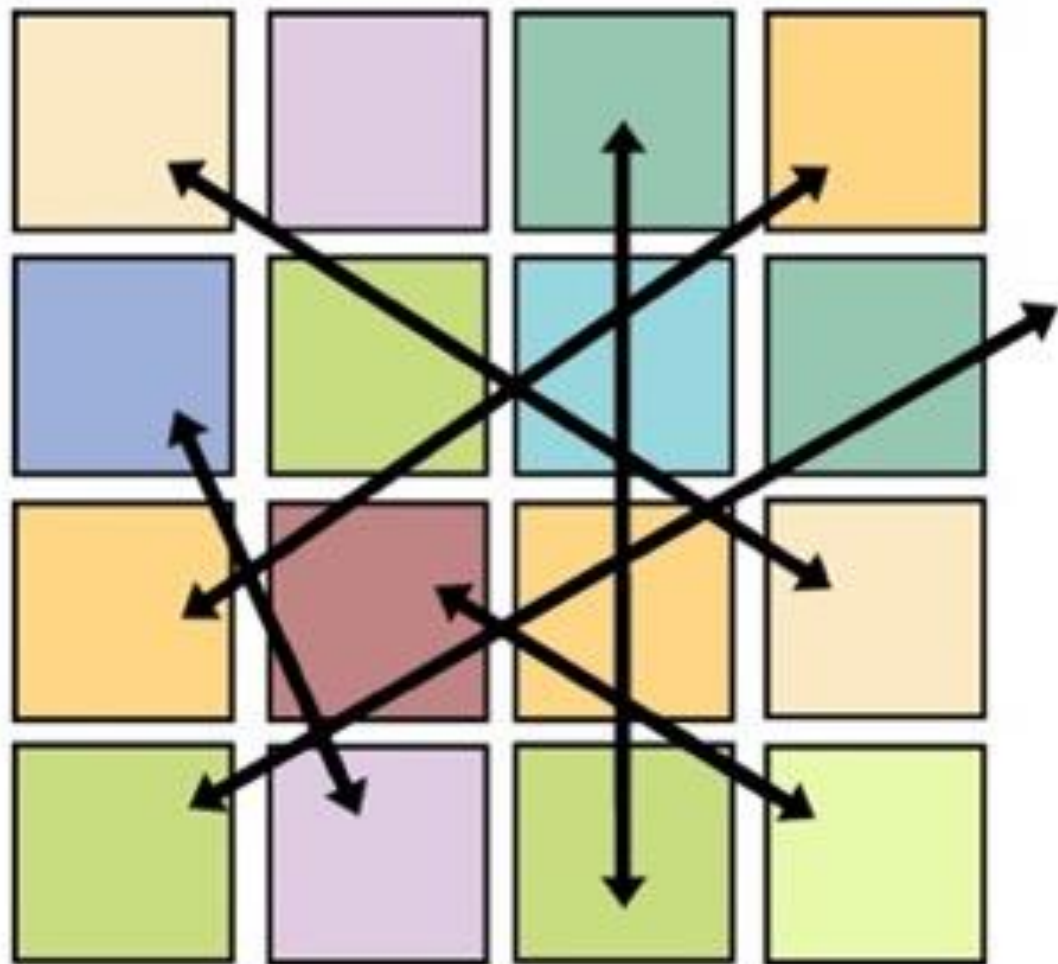
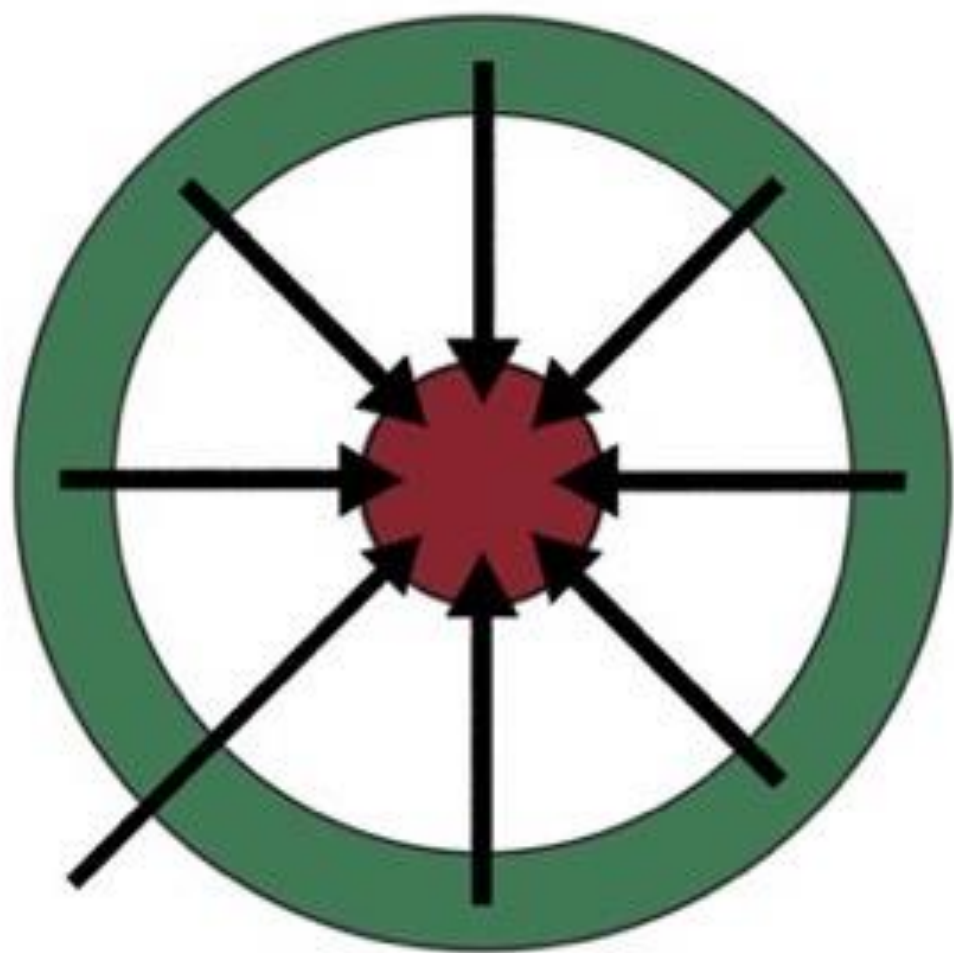
**Environmental
Segmentation**

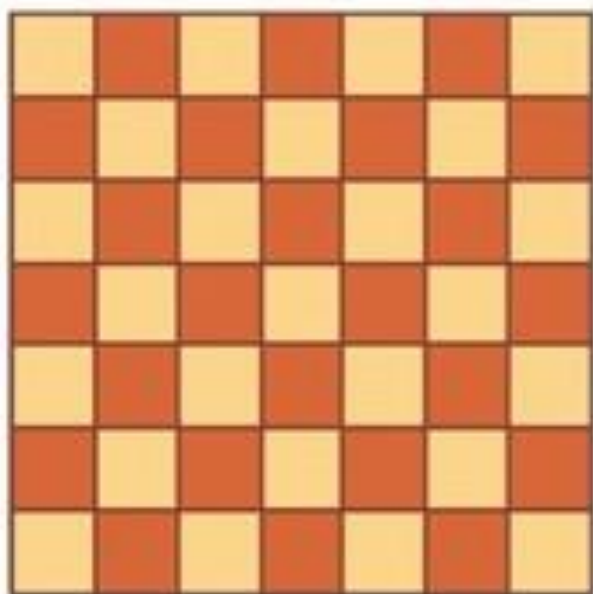
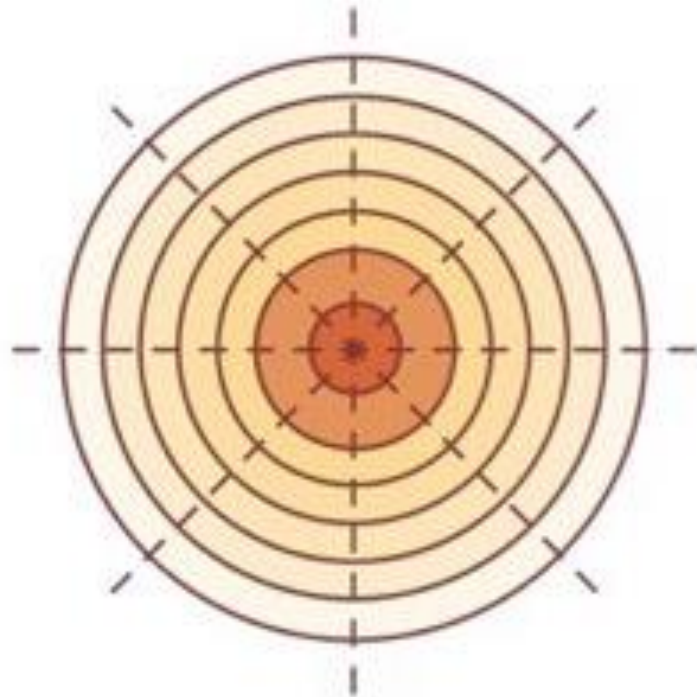
- Metropolitan Core
- Outer Core
- Major Inter-city Road
- Principal Metropolitan Sub-Center
- Secondary Metropolitan Sub-Center
- High Density Suburban
- Medium Density Suburban
- Low Density Suburban

Metro-Matrix 1996



Polycentric Structure







Comunidad de
Madrid

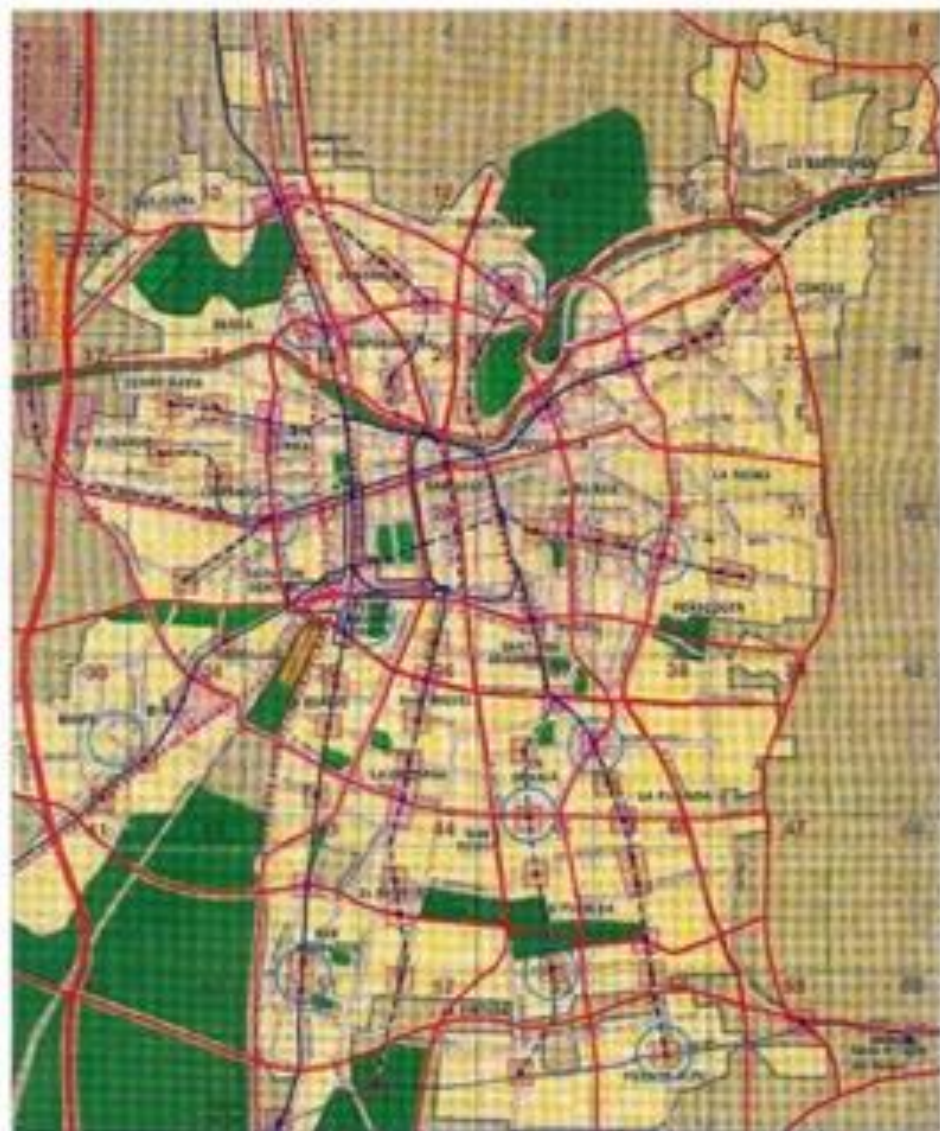
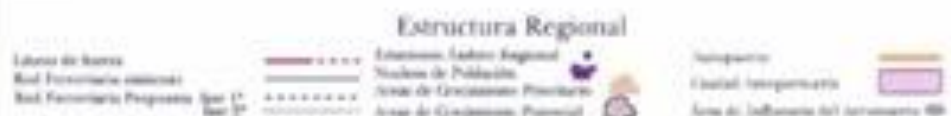
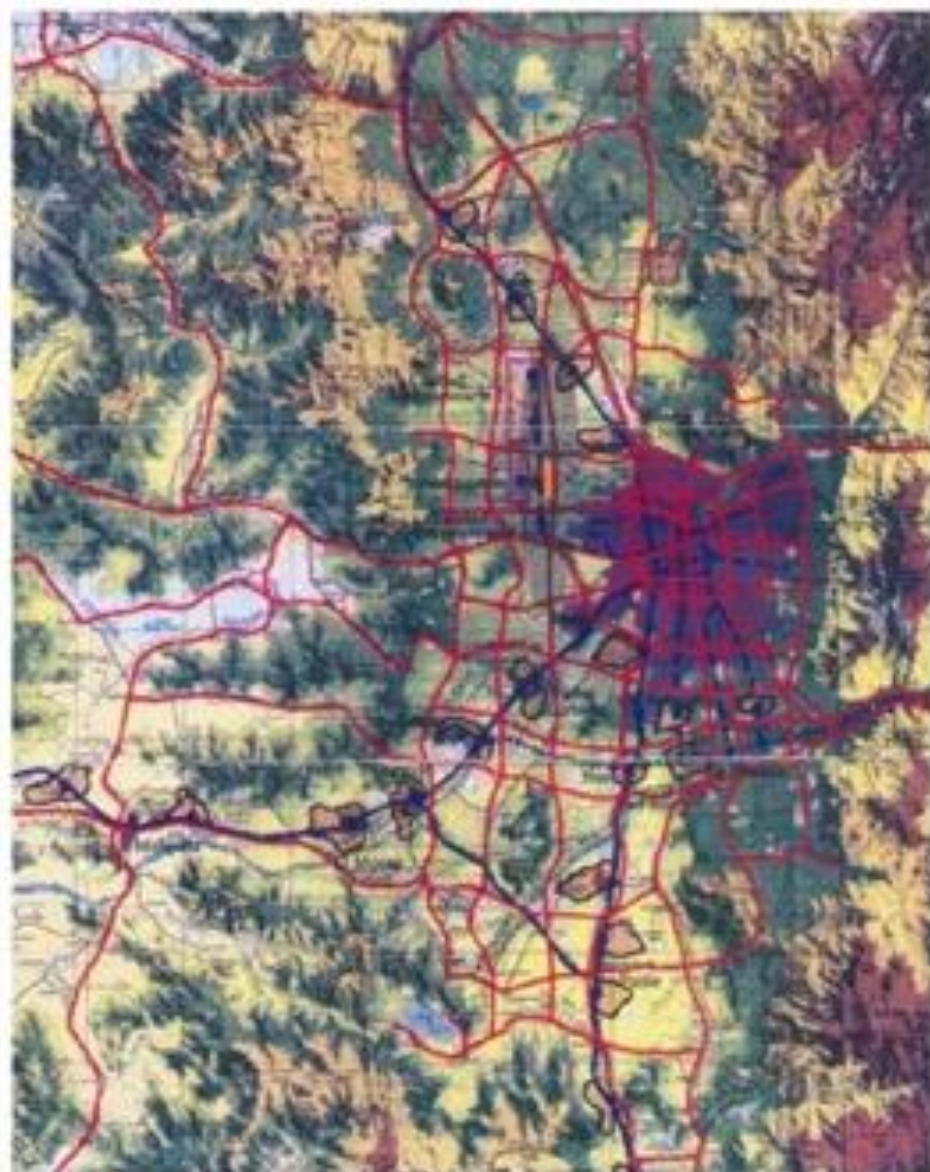
Comunidad de Área Política, Económica y Lingüística
Ministerio de Justicia y Política Social

Madrid 2017

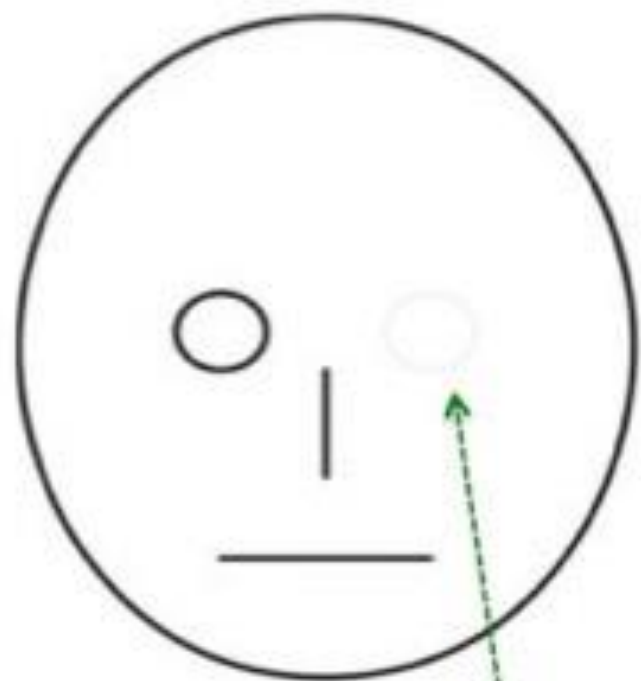
11 / Noviembre / 1997



1998

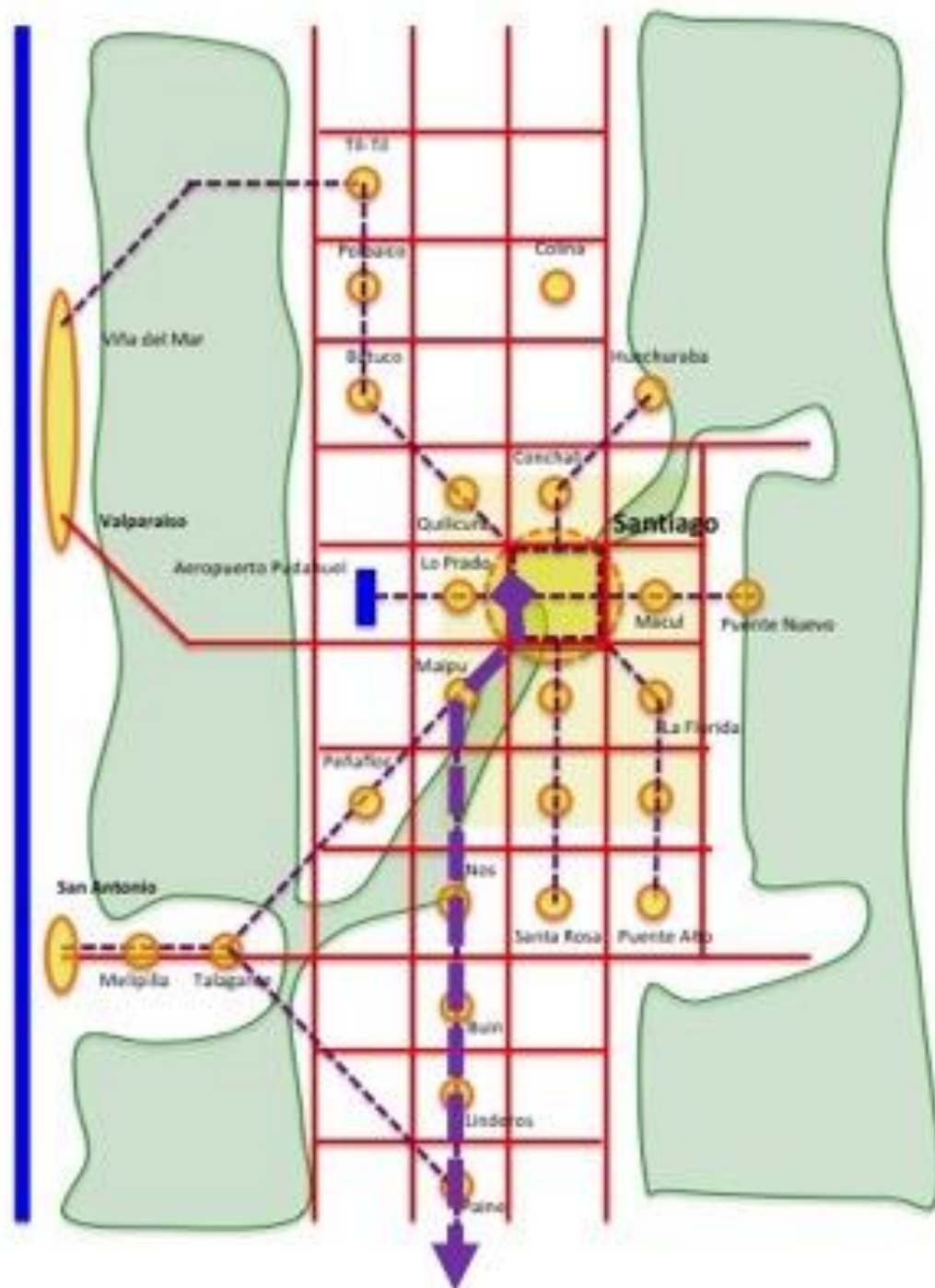


Metro Mental Maps



1998

Pedro B. Ortiz





- ESTACIÓN SERVICIO
ALAMEDA - RANCAGUA
- ESTACIÓN DE COMBINACIÓN
METRO TREN NDS/ METRO TREN RANCAGUA



1998
-
2017



HORARIOS DE OPERACIÓN

	LUNES A VIERNES	SÁBADO	DOMINGOS Y FESTIVOS
HORARIO PRIMER SERVICIO	06:00	07:00	08:00
HORARIO ÚLTIMO SERVICIO	23:00	23:00	23:00

HORARIO BAJO

LUNES A VIERNES	SÁBADO	DOMINGOS Y FESTIVOS
06:00 - 06:30	06:45 - 07:00	07:40 - 08:00
20:00 - 20:30		

INTERVALO	INTERVALO	INTERVALO
15	15	15

HORARIO VALLE

LUNES A VIERNES	SÁBADO	DOMINGOS Y FESTIVOS
06:00 - 06:30	07:00 - 08:00	08:00 - 08:40
19:00 - 21:00		
20:00 - 20:40		

INTERVALO	INTERVALO	INTERVALO
12	12	12

HORARIO PUNTA

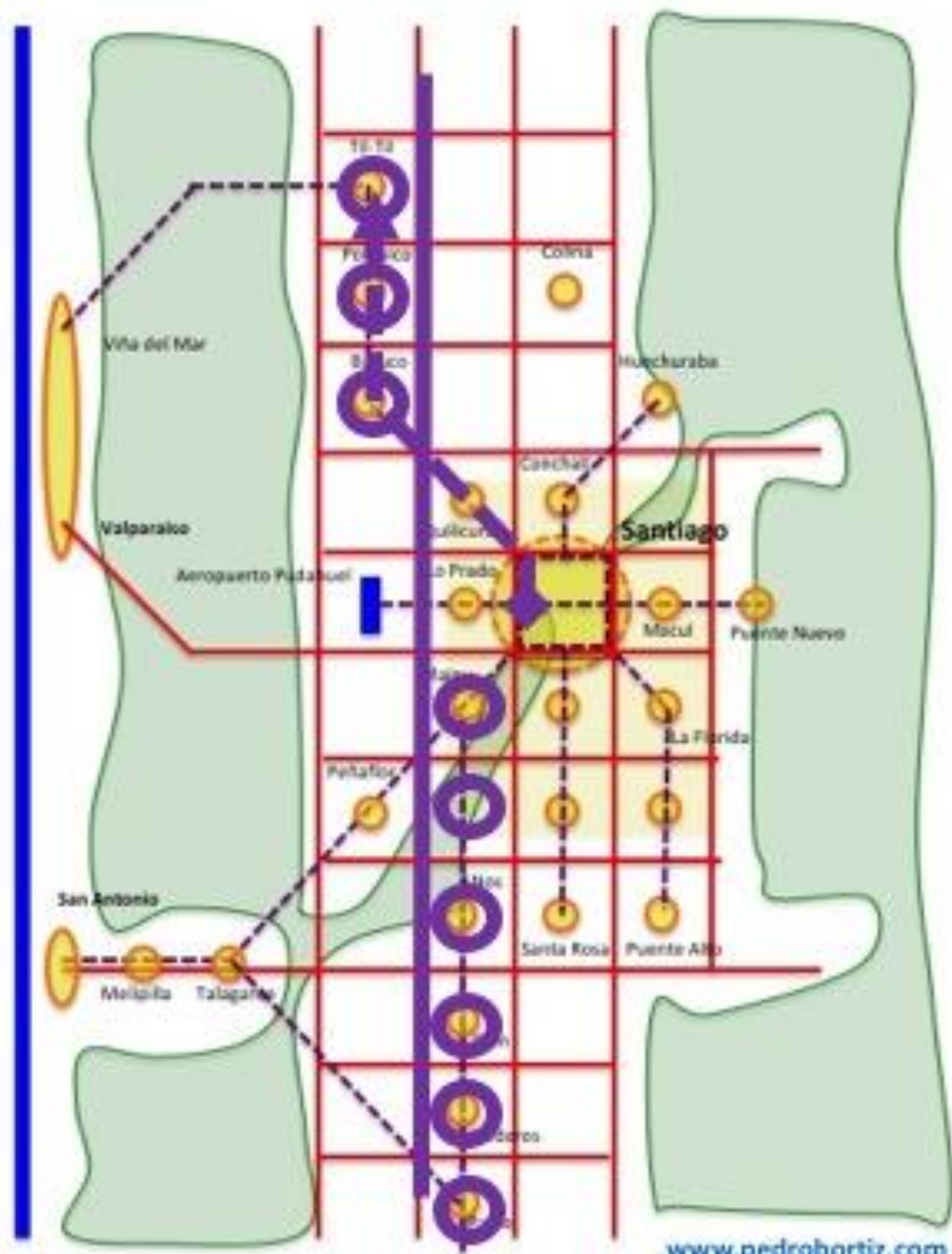
LUNES A VIERNES	SÁBADO	DOMINGOS Y FESTIVOS
07:00 - 08:00		
18:00 - 18:30		

INTERVALO
5



1998

Pedro B. Ortiz



2038

'Descongestión'

- 1) Cercanías norte
- 2) Centralidades Urbanas
- 3) Axialidad Metropolitana
- 4) Tren aeropuerto
- 5) Reserva Aeropuerto 4 pistas
- 6) Integración discontinua Maipo
- 7) etc...





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Gracias