The City As A Spaceship (CAAS) was conceived as a thought experiment to explore the reciprocities between terrestrial and extra-terrestrial architecture and design.

WHY US?

We are curious, restless, thoughtful designers and engineers, makers and growers. We have the skill set and tool set to think, formulate, implement and promote the philosophy that CAAS represents.

We see the space world exists in isolation. We don't see why one should draw a line between Earth and Space. The commonalities and crossovers between terrestrial and extra-terrestrial living are so obvious to us that we cannot stand back and let that pass by. We feel both responsible and inspired to integrate and share.

We are manifestations of past generations and embodiments of future generations. We are the children of Apollo and the space race. And the children of early awareness of competing ideologies of exploration, industrial achievement and environmental crises. We arrived on this planet when the environmental and peace movements and social experiments were at their prime.

We are now at a stage in our lives where we have seen the dismantling of our ancestral homes and we choose to use our knowledge and experience and connections to inform and nurture future conceptualizations of how to live and thrive without damaging the planet we are on now, or in the future.

WHY CAAS?

Half the world's 7.29 billion inhabitants (Population Clock at 21.11 GMT on 29/01/2015) live in urban settings. Sao Paolo, Tokyo, Mexico City, Mumbai, Moscow, New York City, Hong Kong, London are the big cities, the Megatropolises, which all have rapidly growing populations within their densely packed urban centres with equally densely packed peripheries. Living conditions on Earth must change, irrespective of economic or social status, so that we can equalize opportunity and achieve a better standard of living for all.

We propose that the (mega)City and the Spaceship be viewed as parallel and reciprocal case studies to think about contemporary forms of working and personal engagement; compact spaces, multifunctional spaces, public-private spaces, resource management, alternative energy harvesting, waste management, health management and inclusion of nature into our built-up environment.

City As A Spaceship (CAAS) inspires innovation by positing the spaceship as an analogy of the modern, densely built urban space, with its complex structures and technologically advanced infrastructure, where the designed intention is to configure all systems to eco-efficiency to optimize the use of available resources. We believe the time is now to meet our primary needs through CAAS architecture and design, using technologies for space that can immediately impact the humane retrofitting of these cities.

The CAAS City can be an inspiration, an alternate view, for a future city and a way to project and achieve our dreams and visions of an equitable and environment-friendly urban life.

While past visions of future cities were often inspired by space and exploration of the unknown, and thus based in science fiction, the Collective proposes future visions of the city be based in science fact; that which is known and learned from our accumulated space exploration experience.

WHY NOW?

We think of a wonderful, yet obvious symbiosis – tomorrow's space ideas shape today's cities. And investment in today's cities serve as a vehicle and test-bed to both subsidize and implement tomorrow's space endeavors. The implications for what we seek to address are now relevant, significant and urgent, especially in the present day context when global climate change is staring us in the face.

The industrialized world is re-thinking the results of several decades of thoughtless depredation of the Earth. The other population centers are urbanizing at a monstrous pace and doing it much the same way as the industrialized world did in the preceding decades.

The world needs new answers if we are to stand a chance to keep the world habitable and sustainable.

"The Earth as a Spaceship" is not merely a metaphor; it is a tangible, viable way for the future survival of humankind.

MAPPING CAAS

In 2014, the CAAS Collective, in collaboration with Swiss student Rüede Anne-Marlene, explored the "city" as a "spaceship" metaphor using graphical representations of information (data). They attempted to map terrestrial tendencies, human density, consumption and waste. This CAAS journal presents four sets of visual data for comparing and contrasting the world's dnsest cities such as Mumbai, Tokyo, New York, Sao Paulo, Cairo, Mexico City, Amsterdam, Paris, Lagos, Johannesburg and compares them to smaller counterparts such as Vienna, San Francisco, and Toronto.

The first set – titled – TENDENCIES – presents a visual vector portrayal of comparative data points such city size, population, population density, waste production, CO2 emissions, power-water-food consumption. As an infographic, it evidences the consumption patterns of cities from industrially advanced nations (e.g. Amsterdam, New York, Paris) outstrips that of the less industrialized ones (e.g. Mexico City, Mumbai, Lagos). But there is more to it than what meets the eye. Even among the industrial nations, the (water, food, power) consumption patterns vary. Further analyses and thinking is necessary to get an in-depth understanding of what these maps convey.

The second set – titled – CITY STRUCTURE AND DENSITY – attempts to depict the population of each of these cities vis a vis their geographical footprint. The black ring indicates the physical size, while the blue ring is an indicator of the population. The intensity of the blue indicates the human density i.e. number of people per square kilometre. Mumbai, Cairo and Paris stand out as the densest cities in this cluster.

The third set – titled – CITY CONSUMPTION AND EMISSIONS - presents a simple input-output graph, where the input takes into consideration – power, water, food consumption and the output lists the waste and CO2 emissions. As with the first set, in the third set one finds the industrialized economies consuming a lot more and thus, spitting out a lot more in terms of waste.

The fourth set - titled - INPUT AND OUTPUT TENDENCIES - represents the input and output data usng visual vector portrayal - similar to the first set to convey consumption patterns irrespective of population density.

The emerging economies will likely catch up with this pattern in the coming decades and the situation might get out of hand putting the future of the planet in peril. Several questions come to mind when one surveys these graphic representations of data (information) especially relationships within the datasets. The answers are not immediately obvious, but need further investigations. For example, is the standard of living in a city directly proportional to the levels of consumption? Is there a relationship between power consumption and CO2 emissions? Why do some cities consume a lot more power than they consume food or water? Can a mega city have consumption patterns similar to a micro city? What is the ideal city size?

The graphs also bring forth comparative questions between cities, such as: Are the consumption and emission patterns of New York and Vienna similar? Why is Tokyo's consumption footprint more balanced than the other cities featured in this infographic? Is San Francisco's consumption and waste production vis a vis its population out of control?

The initial CAAS mapping explorations reveal that humans tend to consume more to achieve a higher material standard of living. As the emerging economies move towards higher material comforts and consumption (as did the industrial economies before them), the planet will not be able to sustain the increased levels of cumulative consumption and waste production. This makes the CAAS philosophy ever more relevant, especially in the present day context where world economies are obsessed with "growth". Two of the most populous nations on the face of the planet - India and China - are urbanizing at a monstrous pace, and doing it in much the same way as the industrialized world did in the preceding decades. These parts of the world need new answers. The planet needs consumers to become growers and makers.

The CAAS Collective plans to take this mapping exercise forward to extra-terrestrial situations. It believes that these maps can help designers and planners identify, understand, and if need be, alter tendencies for consumption, growth, waste-production, CO2 emissions in ways that are planet-friendly. These maps can help identify patterns that are often lost in hard data and enable intelligent and well-informed resource and waste management decisions, both on and off the planet.

Source Credit: Fairburn, S., Mohanty, S. and Imhof, B., City As A Spaceship (CAAS), # IAC-14-E4.2.8, 65th International Astronautical Congress, Toronto, 2014.

City As A Spaceship

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editors: Susmita Mohanty, Sue Fairburn, Barbara Imhof
guest contributor: Anne-Marlene Rüede

CAAS Collective - Bios

Susmita Mohanty, PhD
Susmita Mohanty is a spaceship designer and aerospace entrepreneur who seamlessly straddles the world of architecture, design, technology and business. She is the co-founder and CEO of Earth2Orbit, India's first private start-up and her third venture. Her other two ventures include MoonFront (2001-07, San Francisco) and LIQUIFER Systems Group (2004 onwards, Vienna). Prior to turning entrepreneur, she worked for the International Space Station Program at Boeing in California and did a short stint at NASA Johnson in Houston. Educated in India, France, and Sweden, Susmita holds multiple degrees including a PhD.

Barbara Imhof, PhD
Barbara Imhof is a space architect and the co-founder and co-manager of the LIQUIFER Systems Group <www.liquifer.com>, a platform for a group of experts from the fields of architecture, design, human factors, systems engineering, physics and space technology. She has extensive project experience in trans-disciplinary, cross-cultural and cross-generational collaborations that have generated innovative research and applications for space and planet Earth – current projects of interest include GrAB (Growing as Building) and SHEE (Self-deployable Habitat for Extreme Environments). In addition, she has nearly 15-years of teaching at renowned Universities. Educated in architecture in Vienna, London, and Los Angeles, Barbara holds multiple degrees including a PhD.

Sue Fairburn, MSc MEDes, FRSA
Sue Fairburn is a Design Educator and Researcher who works between the boundaries of the body and the environment. Her research experience, gained over 20+ years, uses Design as knowledge exchange applied to Social Design and as reciprocities in Design for Extremes. She was co-founder of a Social Enterprise, Design for Development, which used the design process as a problem identification and engagement tool in low-income settings. She continues to work in the area of social innovation as CEO of Fibre Design Inc. Educated in Canada in Environmental Physiology and Environmental Design, Sue holds multiple degrees.

We all live on a blue spaceship!

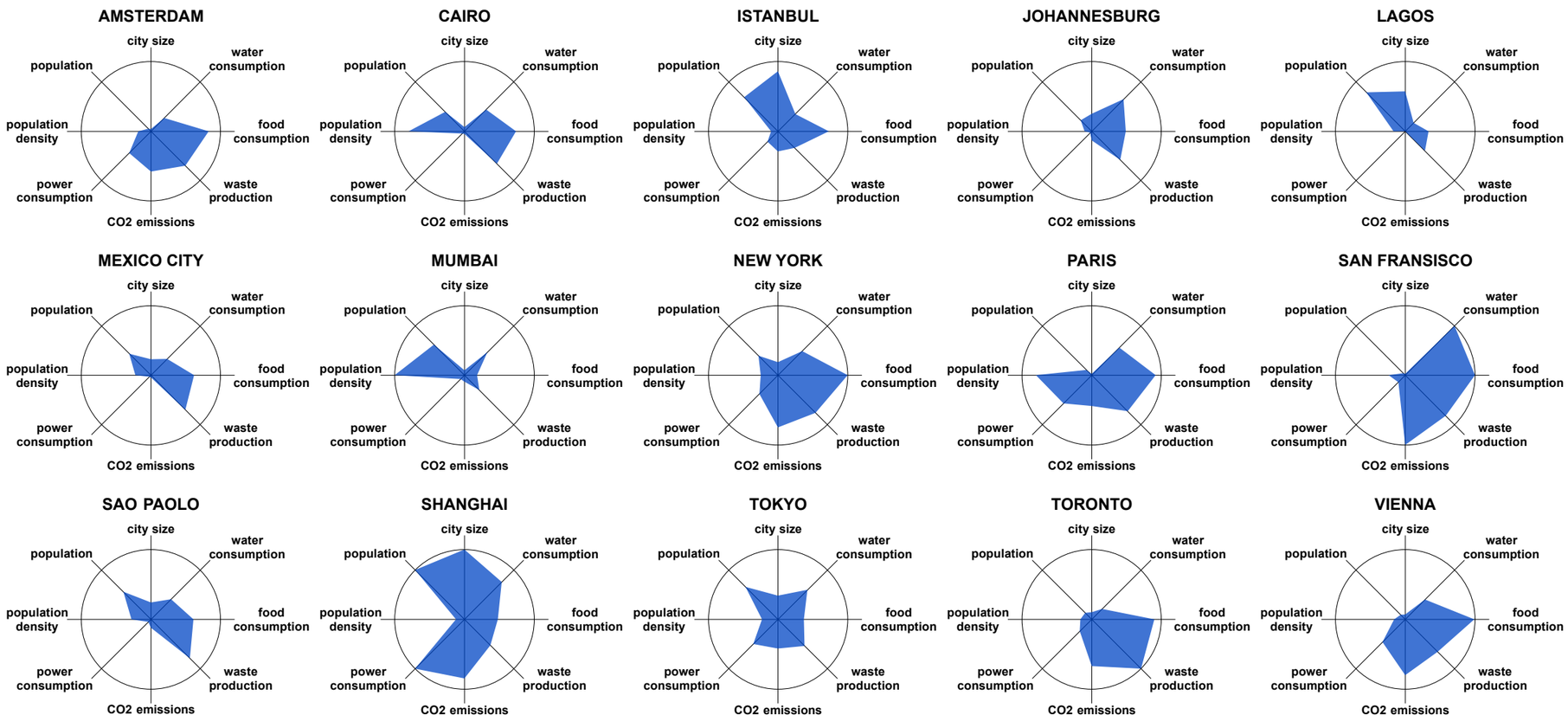
KHOJ INTERNATIONAL ARTIST'S ASSOCIATION · NORWEGIAN EMBASSY · austrian cultural forum del · MAD SALON + LAB · LIQUIFER SYSTEMS GROUP · Fibre

CITIES OF THE WORLD

City Index	Amsterdam	Cairo	Istanbul	Johannesburg	Lagos	Mexico City	Mumbai	New York	Paris	San Fransisco	São Paulo	Shanghai	Tokyo	Toronto	Vienna
City size (sqkm)	219	370	5,343	1600	3600	1,485	468	1,214	105	126	1,523	6341	2,187	621	415
Population (pers)	1,027,860	7,902,085	13,907,015	4,434,827	16,060,303	8,874,700	12,442,373	8,175,133	2,249,975	805,235	11,253,503	20,217,748	13,286,735	2,615,060	1,766,746
Population density (pers/sqkm)	4687	21357	2603	2772	4461	5976	26586	6734	21347	6391	7389	3189	6075	4211	4257
CO2 emission (kg/person/year)	6660	477	3250	1,484	36	318	1000	8600	5040	11400	1400	9700	4800	7600	5190
Waste (kg/pers/year)	487.1	456.9	234.6	401.3	276.0	489.0	209.0	529.0	506.0	570.0	550.0	369.5	375.1	697.0	458.3
Power consumption (GJ/pers/year)	74.5	8.0	36.2	5.6	0.8	5.7	14.2	64.7	96.7	24.5	8.3	169.7	84.9	40.2	78.7
Water consumption (l/pers/day)	146.5	237.0	188.0	348.7	90.1	178.0	250.0	262.3	300.0	537.5	220.5	411.1	320.2	113.8	217.5
Food consumption (calories/day)	3495	3,356	3328	2962	2714	3171	2473	3754	3623	3754	3146	2,940	2768	3605	3732

Values of city characteristics for a given parameter

TENDENCIES:



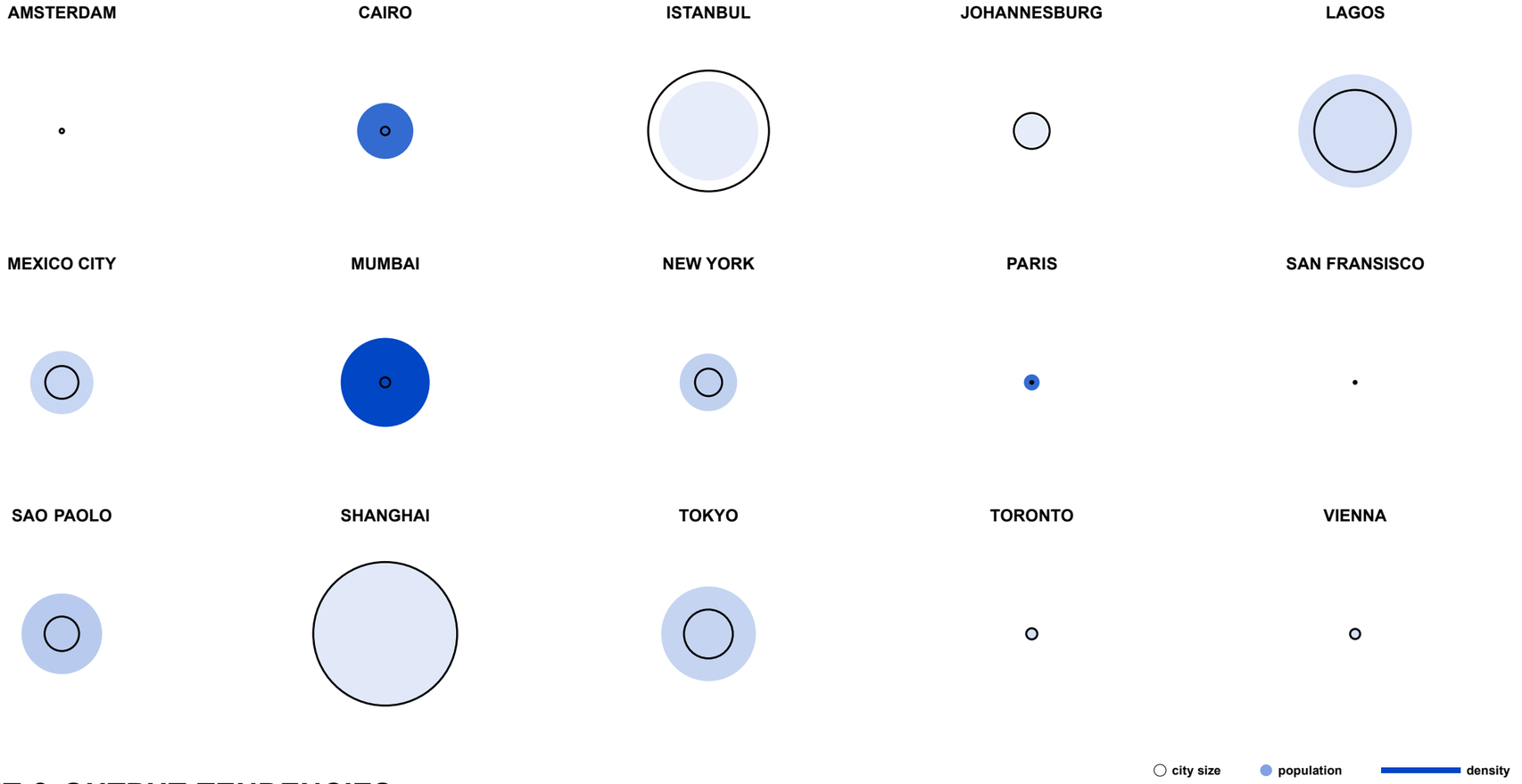
CAAS presents three sets of visula data sets attempting to compare and contrast the world's densest cities such as Mumbai, Tokyo, New York, Sao Paolo, Cairo, Mexico City, Amsterdam, Paris, Lagos, Johannesburg and compares them to smaller counterparts such as Vienna and San Fransisco.

The 1st set - titled TENDENCIES - presents a visual vector portrayal of comparative data points such as city size, population, population density , waste production, CO2 emissions, power-water-food consumption. As is evident, the consumption patterns of cities from industrialially advances nations (e.g. Amsterdam, New York, Paris) outstrips that of the less industrialized ones (e.g. Mexico City, Mumbai, Lagos).

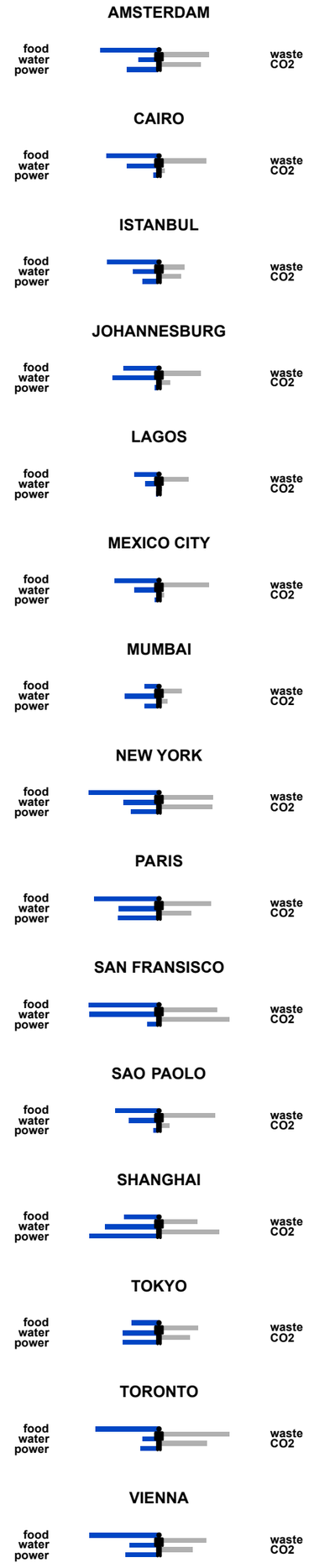
The 2nd set attempts to depict the population of each of these cities vis a vis their geographical footprint. The black ring indicates the physical size, while the blue ring is an indicator of the population. The intensity of the blue indicates the human density i.e. number of people per square kilometer. Mumbai and Paris stand out as the densest cities in this cluster.

The 3rd set presents a simple input-output graph, where the input takes into consideration - power, water, food consumption and the out put lists the waste and CO2 emissions. As with the 1st set, one finds the industrialized economies consuming a lot more thus, spitting out a lot more in terms of waste. The emerging economies will likely catch up with this pattern in the coming decades and the situation might get out of hand putting the future of the planet in peril.

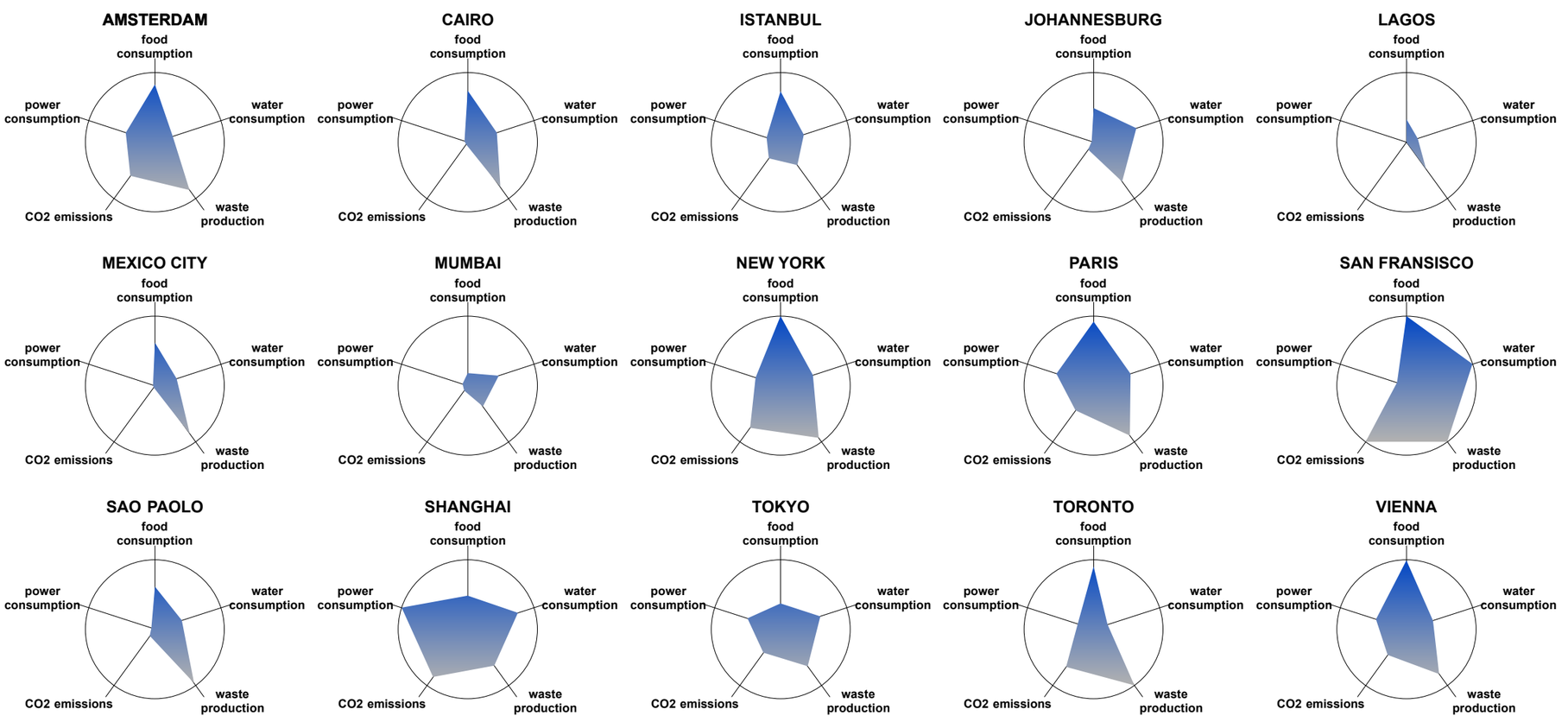
HUMAN DENSITY:



INPUT & OUTPUT:



INPUT & OUTPUT TENDENCIES:



City Index	Amsterdam	Cairo	Istanbul	Johannesburg	Lagos	Mexico City	Mumbai	New York	Paris	San Fransisco	São Paulo	Shanghai	Tokyo	Toronto	Vienna
City size (%)	3	6	84	25	57	23	7	19	2	2	24	100	34	10	7
Population (%)	5	39	69	22	79	44	62	40	11	4	56	100	66	13	9
Population density (%)	18	80	10	10	17	22	100	25	80	24	28	12	23	16	16
CO2 emission (%)	58	4	29	13	less than 1	3	9	75	44	100	12	85	42	67	46
Waste (%)	70	66	34	58	40	70	30	76	73	82	79	53	54	100	66
Power consumption (%)	44	5	21	3	less then 1	3	8	38	57	14	5	100	50	24	46
Water consumption (%)	27	44	35	65	17	33	47	49	56	100	41	76	60	21	40
Food consumption (%)	83	74	73	49	33	62	18	100	92	100	61	48	37	90	99

Percentage of city characteristics compared to the city with the highest value for a given parameter

Data Source Credit:
Siemens Green City Index, 1996-2010
StatInfo, 2007-2014
City Population, 1998-2014