

MSc Climate Change and Sustainable Development
Resource Use and Pollution

Sustainable Urban Design
Systems ... Models ... Agents ... Graphs ... Examples

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“Sustainable communities meet the diverse needs of existing and future residents, their children and other users, contribute to a high quality of life and provide opportunity and choice. They achieve this in ways that make effective use of natural resources, enhance the environment, promote social cohesion and inclusion and strengthen economic prosperity.”

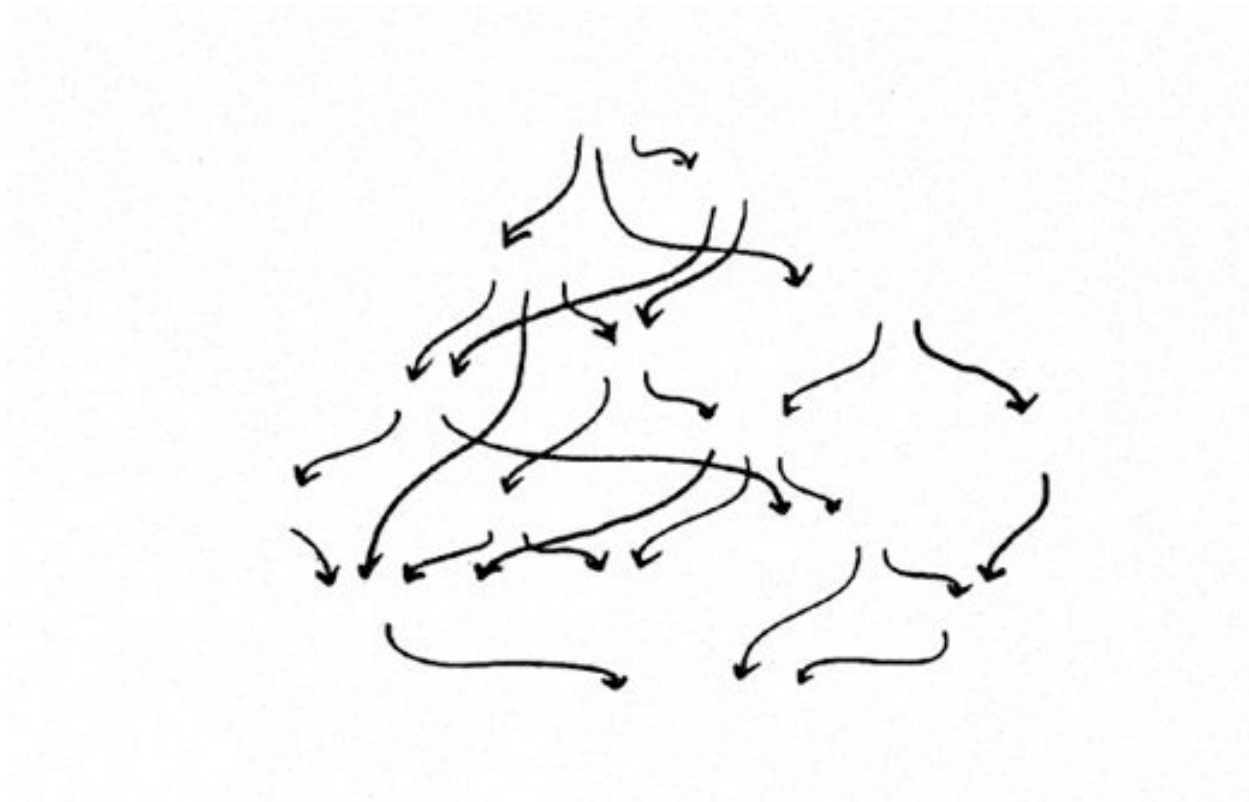
Office of the Deputy Prime Minister [2004] *The Egan Review: Skills for Sustainable Communities* [HMSO, Norwich].

“We recognise that true sustainability will only be achieved through a **holistic** approach, which gives equal consideration to all three elements ... that support economic prosperity, are environmentally responsible and promote social integration.”

CABE [November 2004] *Environmental Sustainability and the Built Environment – Position Paper* [Commission for Architecture and the Built Environment, London].

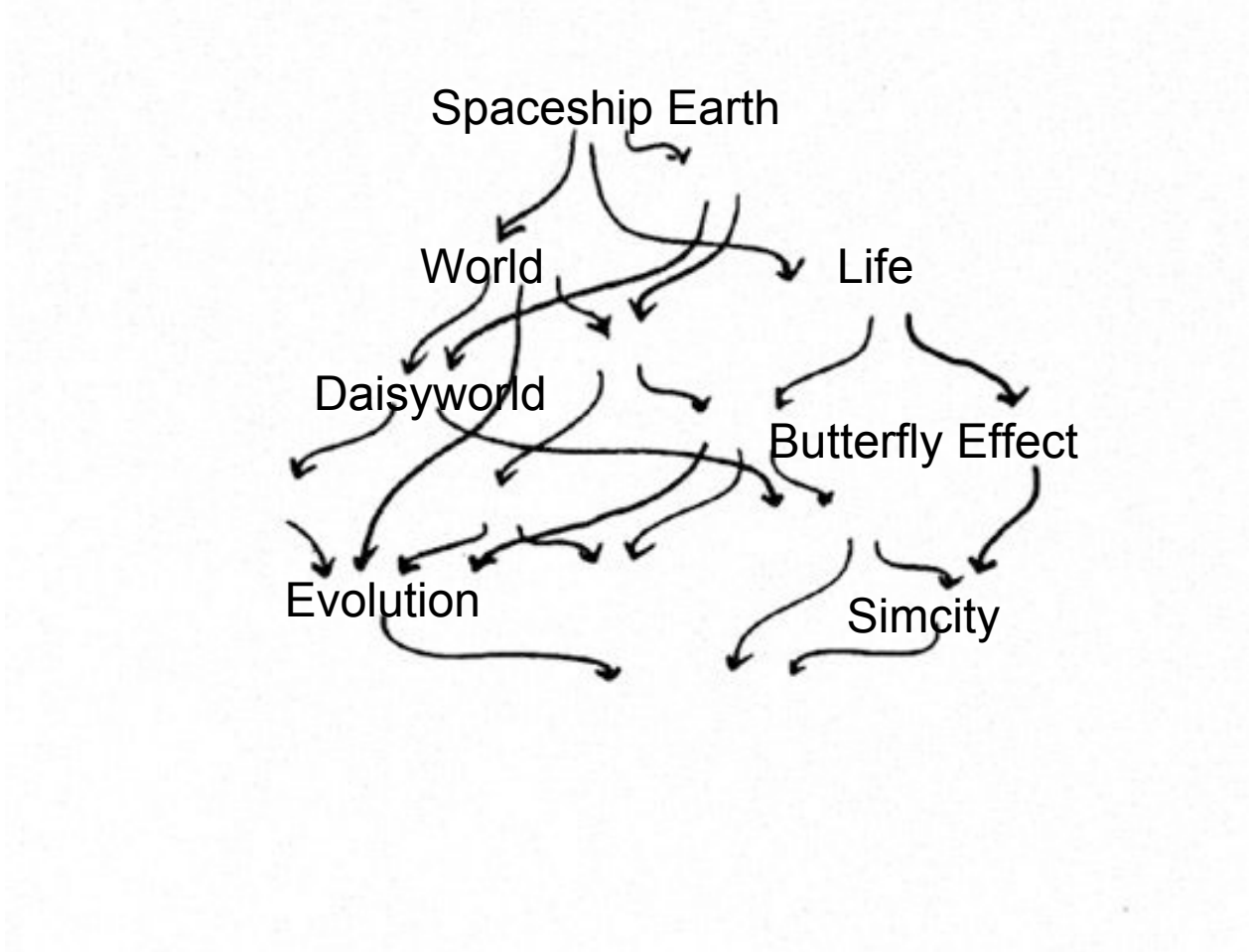
“Community is an important word for ... ‘understanding the urban’. ... They are **holistic** rather than differentiated. People know each other and regard each other as part of the same social unit.”

David Byrne [2001] *Understanding the Urban* [Palgrave, London].



“It is a **process** which brings order out of nothing but ourselves”

Christopher Alexander [1979] *The Timeless Way of Building*.



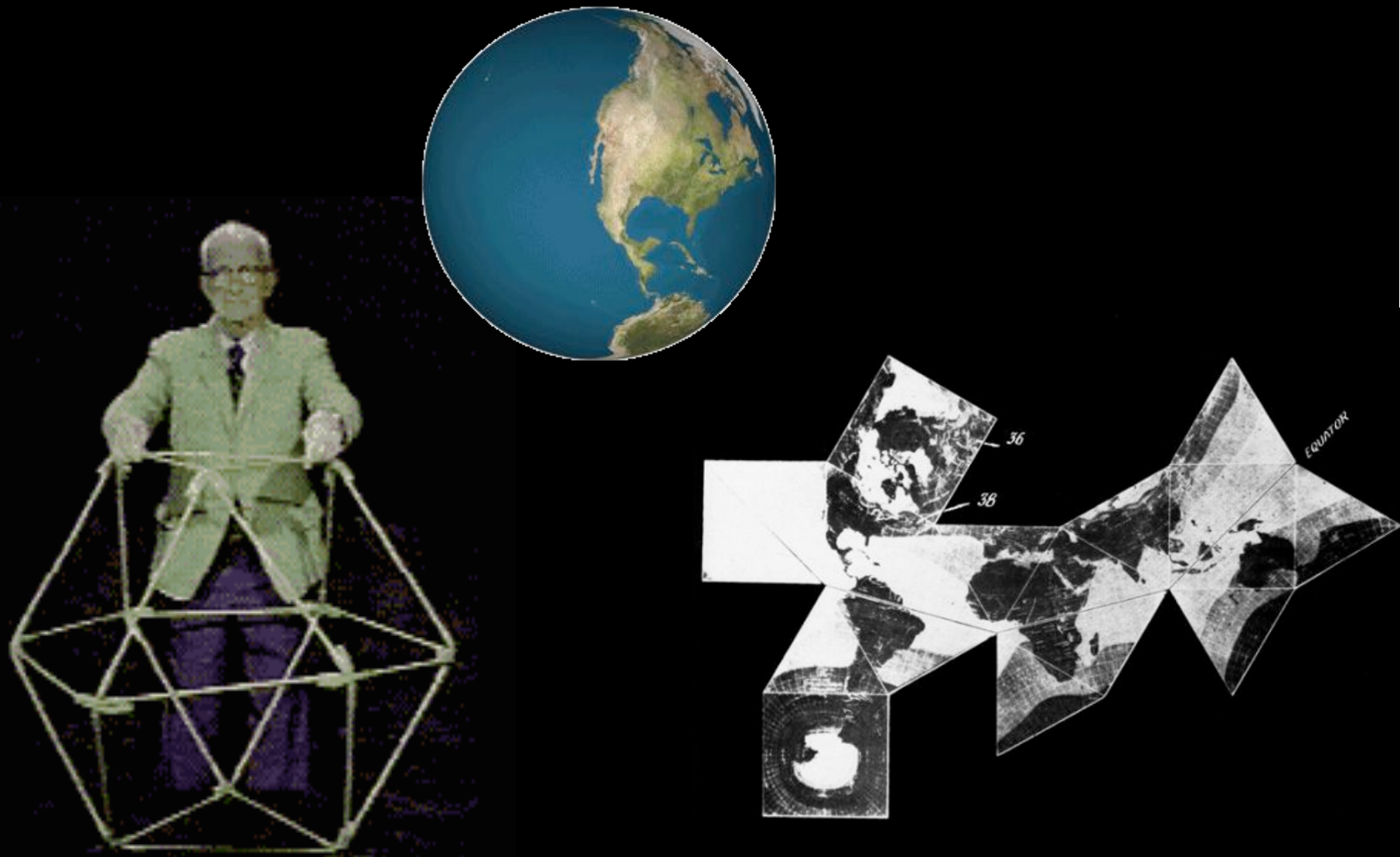
OPERATING MANUAL FOR



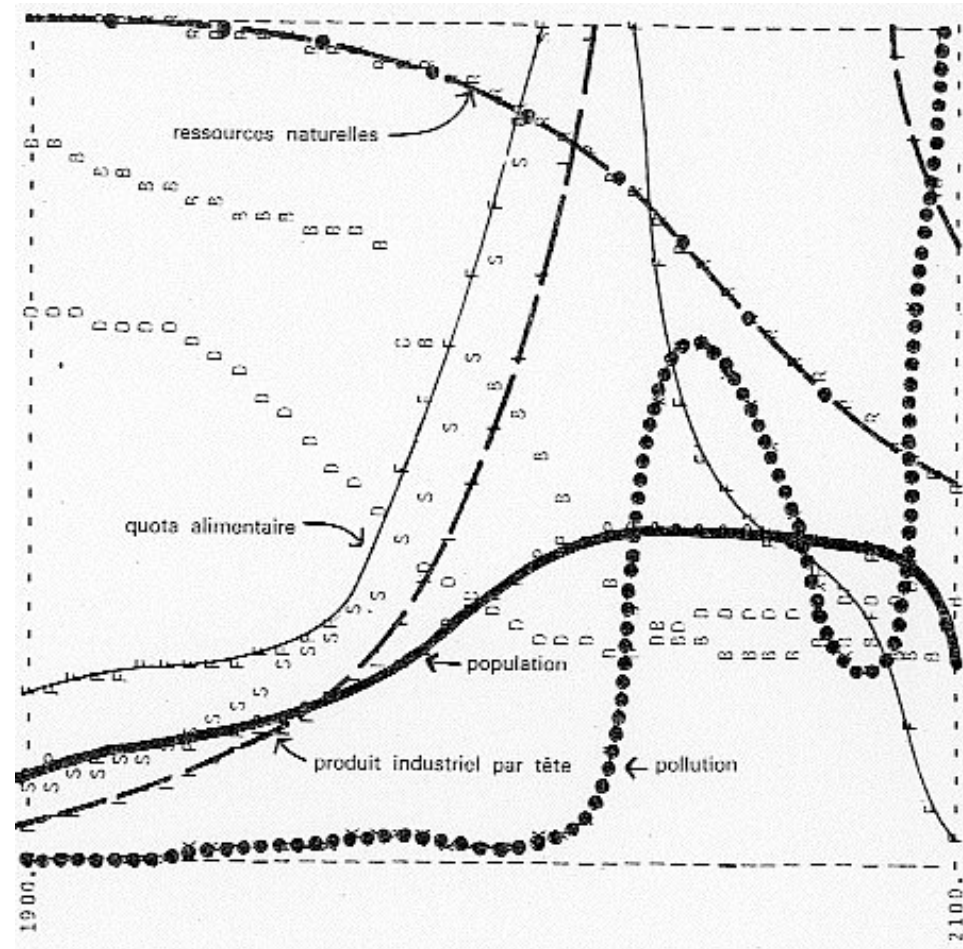
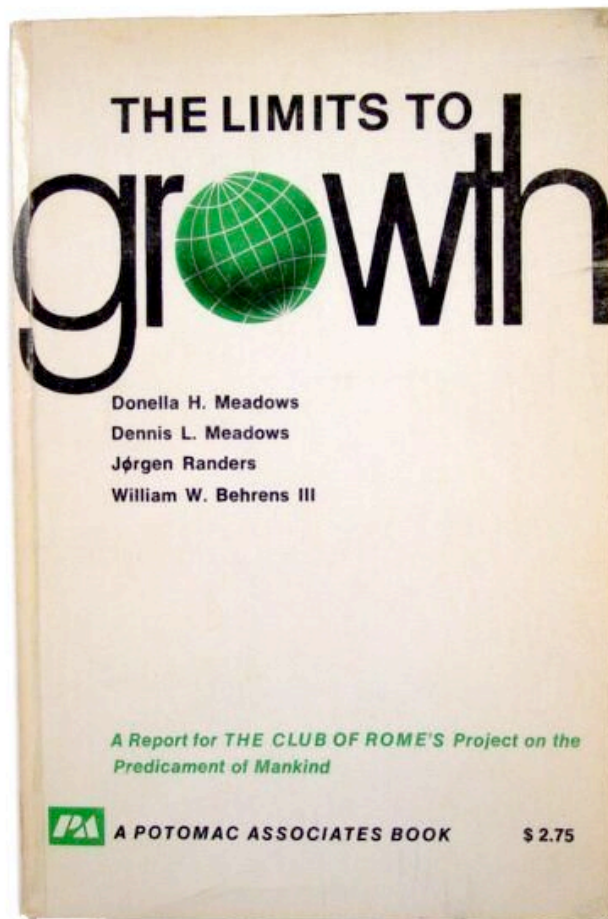
SPACE SHIP

EARTH

R. Buckminster Fuller



Buckminster Fuller [1963] *Operating Manual for Spaceship Earth* [Southern Illinois University Press, Carbondale].
Images from the Buckminster Fuller Institute.

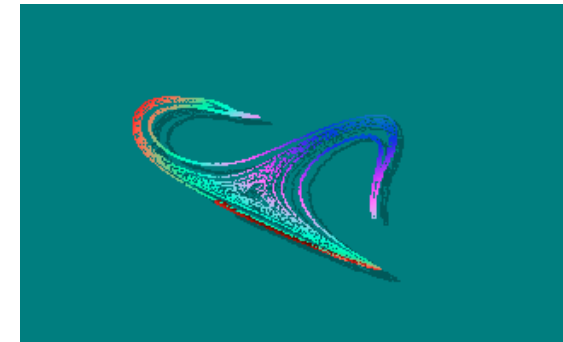
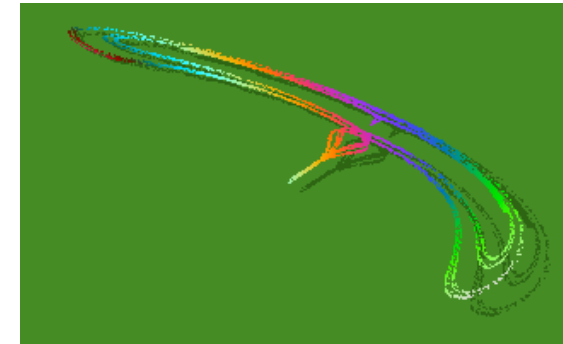
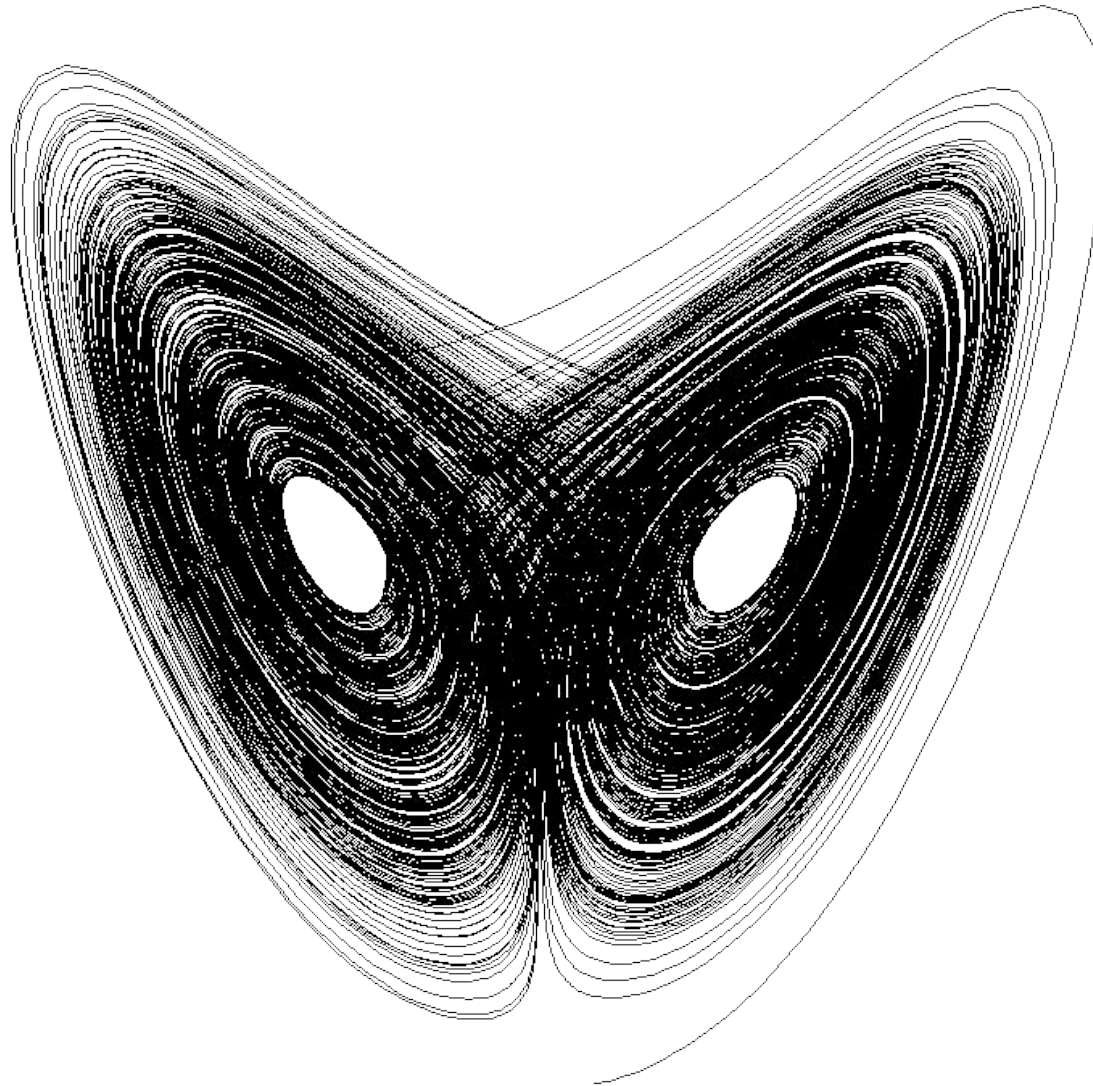


World - a global model significant in its approach to a **systems** based approach and the use of **delayed feedback** relating to a simplistic view of five major trends

Meadows, Donella H.; Meadows, Dennis I.; Randers, Jorgen and Behrens, William W [1972] *The Limits to Growth: A Report for the Club of Rome's Project on the Predicament of Mankind*.



Conway's game ***Life*** – a cell based 'game' where 'decisions' of ***agents*** are based on the neighbouring cells.



The Lorenz Attractor [$x' = -s x + sy$ $y' = Rx - y - xz$ $z' = -Bz + xy$
 $[dx/dt = 2z, dy/dt = -2y + z, dz/dt = -x + y + y^2]$ $[x_{new} = a + bx + cx^2 + dy + ez + f \sin(\pi t/8), y_{new} = x, z_{new} = y,$ where a
 through f are constants] Lorenz, Edward [December 1972] 'Predictability: Does the flap of a Butterfly's Wings in Brazil Set
 off a Tornado in Texas?' Paper presented to the *American Association for the Advancement of Science*, Washington, D.C.

```

import math
def print_sorted_keys(dict,width): keys = dict.keys() keys.sort() f = "%"+str(width)+"s" for key in keys[:-1]: print
(f+"," ) % key, print f % keys[-1]
def print_sorted_values(dict,width): keys = dict.keys() keys.sort() f = "%"+str(width)+"s" for key
in keys[:-1]: print (f+"," ) % dict[key], print f % dict[keys[-1]]
def run_times(initial_time,dt,times,initial,get_next_time_step): prev =
initial width = 20 f = "%"+str(width)+"s," print f % "time", print_sorted_keys(initial,width) print f % initial_time,
print_sorted_values(initial,width) for i in range(1,times+1): time = i*dt + initial_time next = get_next_time_step(prev,time) print f
% time, print_sorted_values(next,width) prev = next print f % "time", print_sorted_keys(initial,width)
def
step(value,time,currentTime): if currentTime >= time: return value else: return 0.0
def
clip(after_cutoff,before,value,cutoff_value): if value < cutoff_value: return before else: return after_cutoff
def
table_lookup(value,low,high,increment,list): if value <= low: return list[0] elif high <= value: return list[-1] else: trans = (value -
low)/increment low_index = int(math.floor(trans)) delta = trans - low_index return list[low_index]*(1.0-
delta)+list[low_index+1]*delta
def smooth3_init(init_dictionary,name,value): init_dictionary[name+"_l1"] = value
init_dictionary[name+"_l2"] = value init_dictionary[name+"_l3"] = value
def smooth3_next_levels(cur_dict, prev_dict, name, dt):
cur_dict[name+"_l1"] = prev_dict[name+"_l1"]+dt*prev_dict[name+"_r1"] cur_dict[name+"_l2"] =
prev_dict[name+"_l2"]+dt*prev_dict[name+"_r2"] cur_dict[name+"_l3"] = prev_dict[name+"_l3"]+dt*prev_dict[name+"_r3"]
def
smooth3_next_rates(cur_dict, name, value, delay): cur_dict[name+"_r1"] = (value - cur_dict[name+"_l1"])/(delay/3.0)
cur_dict[name+"_r2"] = (cur_dict[name+"_l1"] - cur_dict[name+"_l2"])/(delay/3.0) cur_dict[name+"_r3"] = (cur_dict[name+"_l2"]
- cur_dict[name+"_l3"])/(delay/3.0)
def smooth3_cur_value(cur_dict, name): return cur_dict[name+"_l3"]

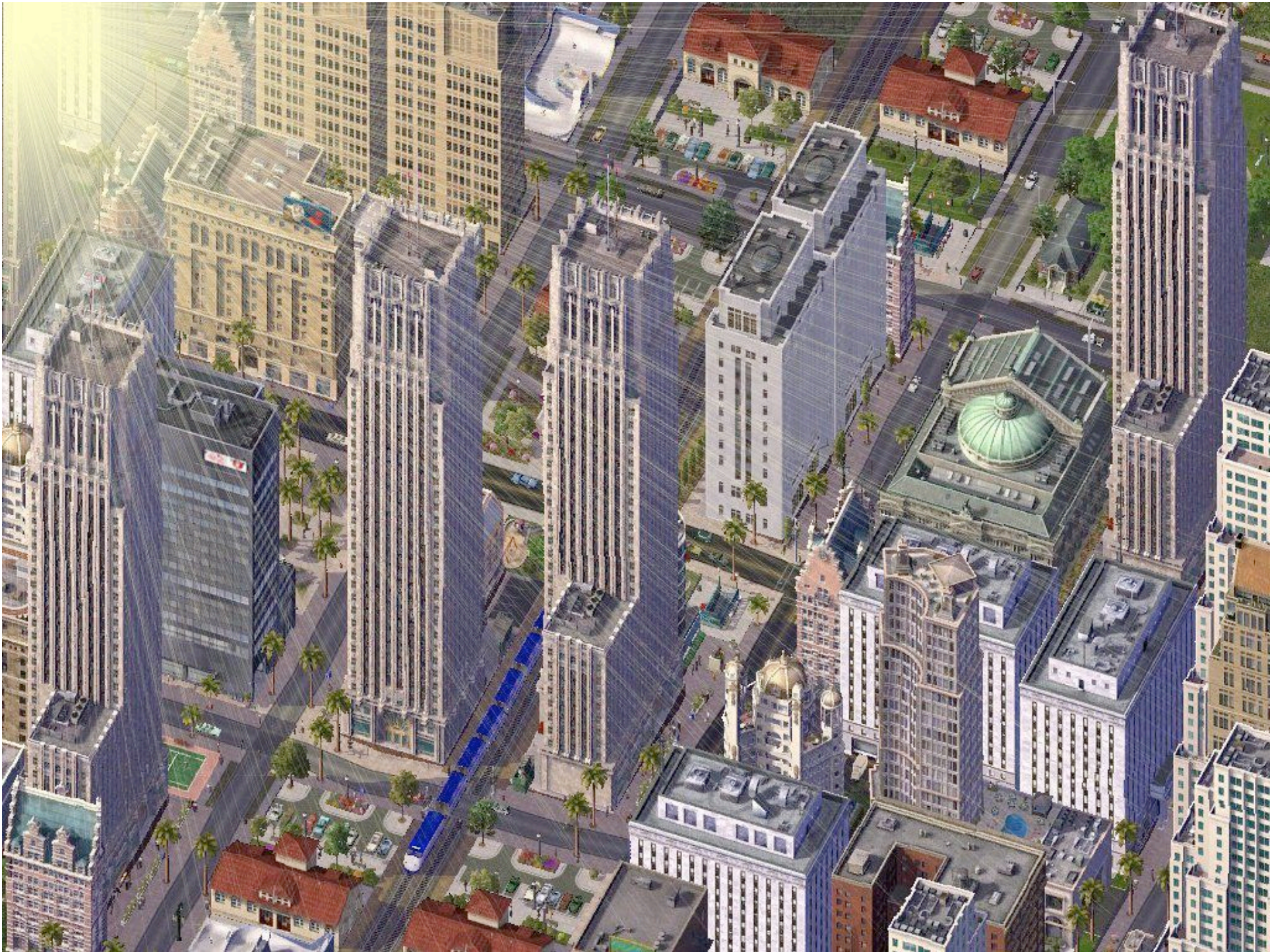
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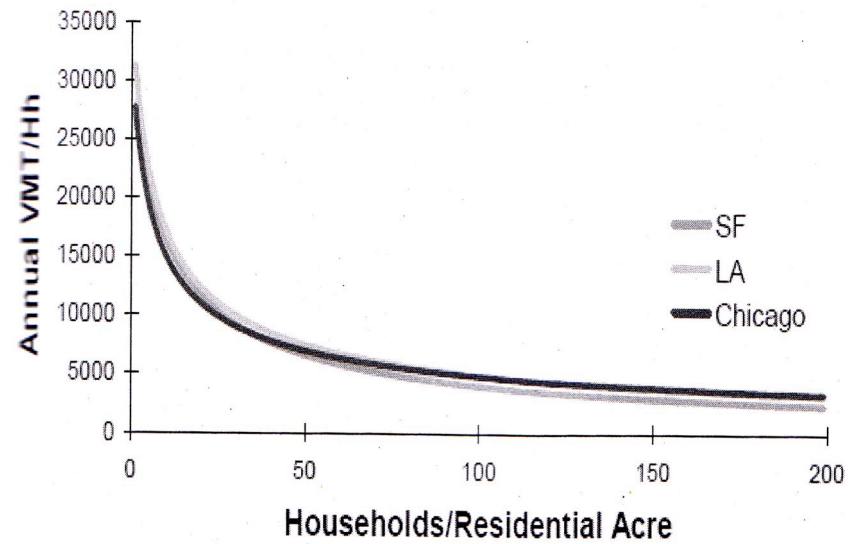
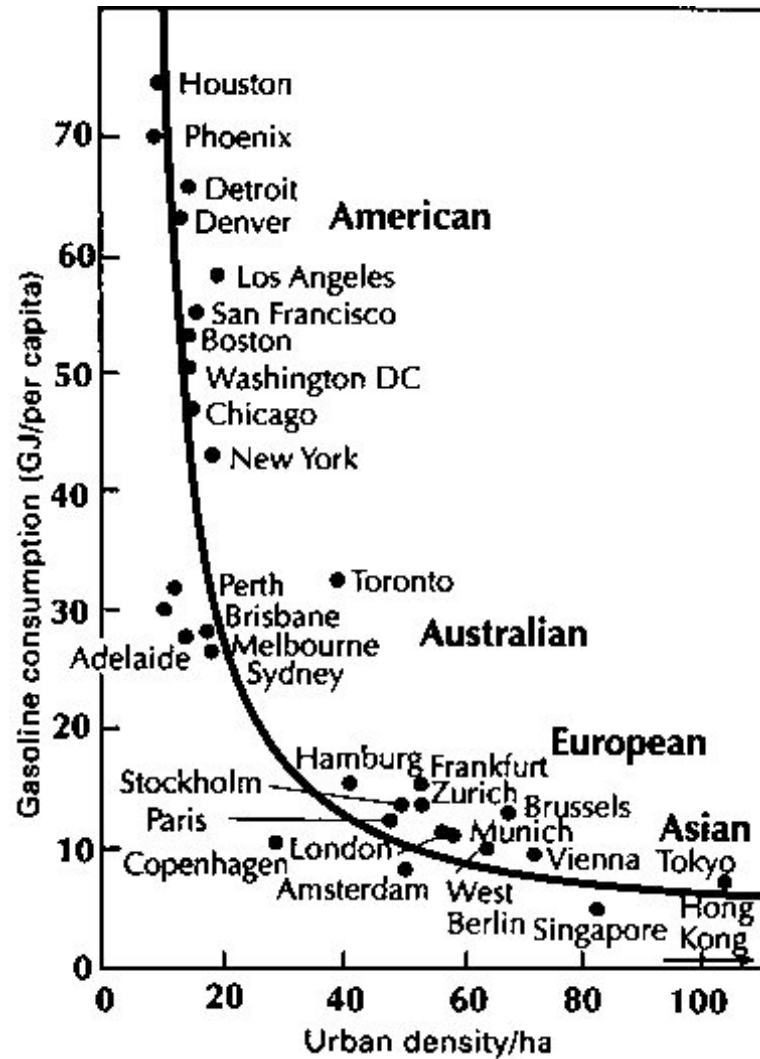
Daisyworld is an early climate control model illustrating **self-regulation** and **adaptation**; in Watson, A. J. and J. E. Lovelock [1983] 'Biological homeostasis of the global environment: the parable of Daisyworld' *Tellus* 35 pp 284-289.



Evolution popular predator – prey model for the Sinclair ZX Spectrum personal computer [1982] based upon the work of biophysicist Alfred Lotka and Vito Volterra [1925] showing the population dynamics of rabbits and foxes without environmental constraints







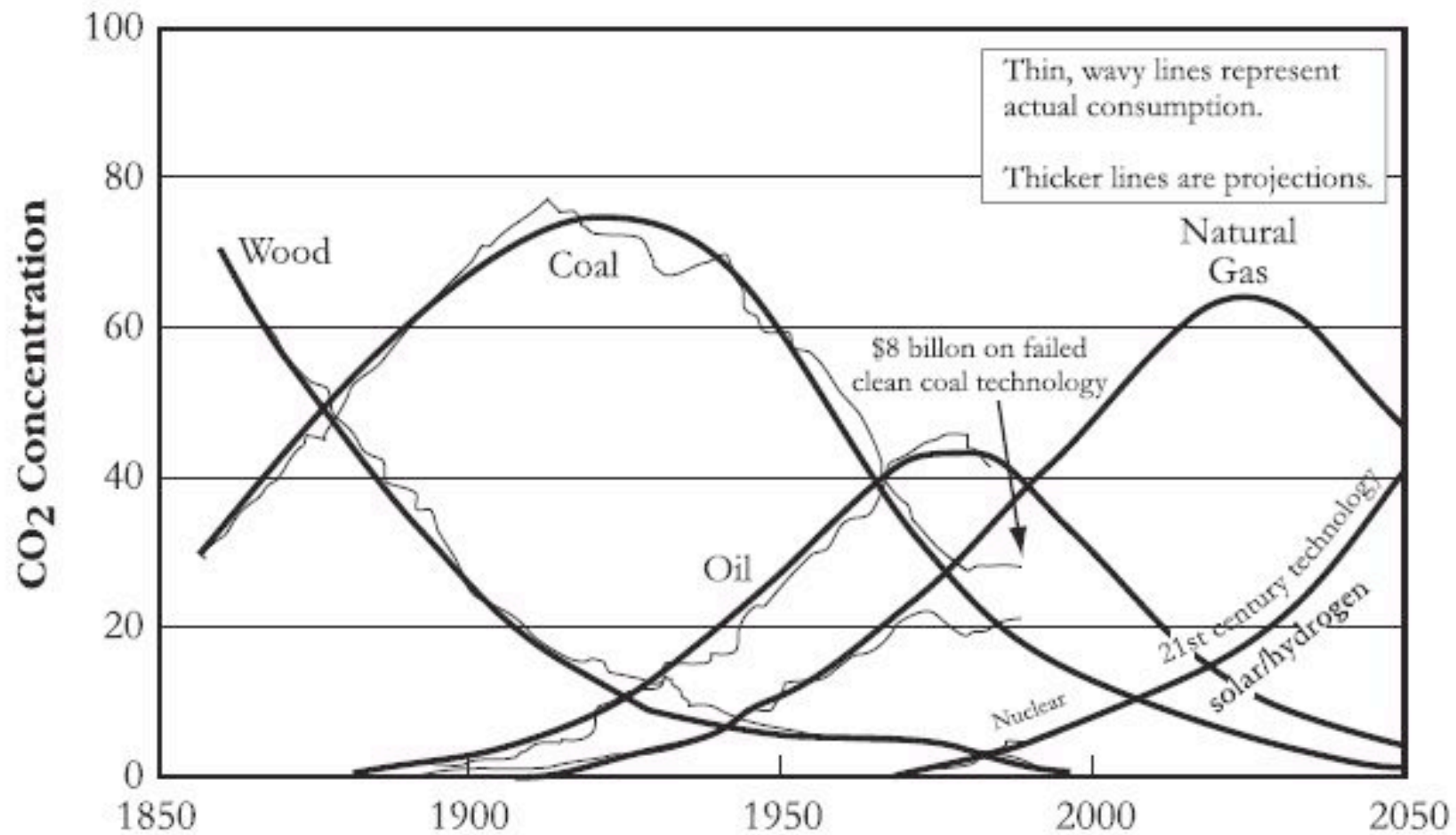
Source: Newman, P and Kenworthy, JR [1989] "Gasoline consumption and cities: a comparison of US cities with a global survey". *Journal of the American Planning Association*. Holtzclaw, John et al [2002] "Location Efficiency: Neighbourhood and Socio-Economic Characteristics Determine Auto Ownership and Use - Study in Chicago, Los Angeles and San Francisco". *Transportation Planning and Technology* 25[1] pp1-27.

the challenge is “... not necessarily to invent the solutions to the problems, rather it was to create a link for people who were already there solving them”

Heintzman & Solomon [2005] *Fueling the Future* [Anansi, Toronto].

“... initiatives for sustainable energy promise to fundamentally restructure the energy industry itself. To stay in the game, the oil industry is evolving away from fossil fuels, towards renewables”

Mau & Leonard [2004] *Massive Change* [Phaidon, London].



World Primary Energy Substitution. Source: Marchetti, C and Nakicenovic, N. [1994] *The Hefner Report* 3[1].

Hydrogen Fuel Cell - Simon Starling Turner Prize winner 2005

“ a physical manifestation of a thought process” - a makeshift motorised bicycle used to ride across the Tabernas desert in southern Spain. It was powered by hydrogen in lightweight canisters that reacted with oxygen in the atmosphere to produce water as a byproduct. The artist used that in turn to paint a simple watercolour of a cactus he found en route.



“Close examination of recent housing quality standards ... indicates a tendency to adopt a piecemeal approach that relies on outdated data sources and references ... [a] process of cobbling together existing standards”.

p739 in; Milner, Jo and Madigan, Ruth [2004] Regulation and Innovation: Rethinking Inclusive Housing Design. *Housing Studies* 19[5] pp 727-744.

DELIVERING QUALITY PLACES URBAN DESIGN

COMPENDIUM 2



English Partnerships
The National Regeneration Agency

HOUSING
CORPORATION

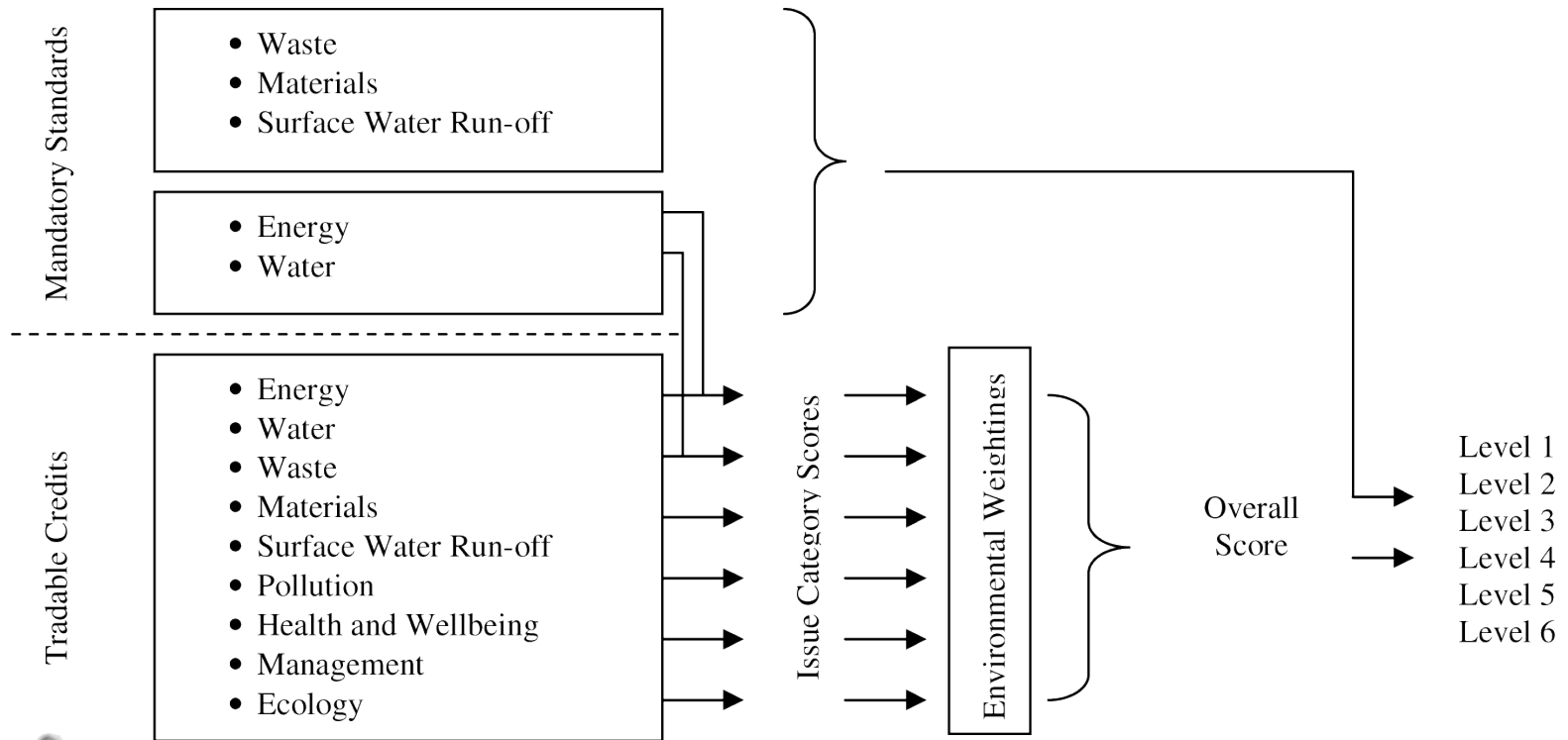
Communities
and Local Government

Code for Sustainable Homes

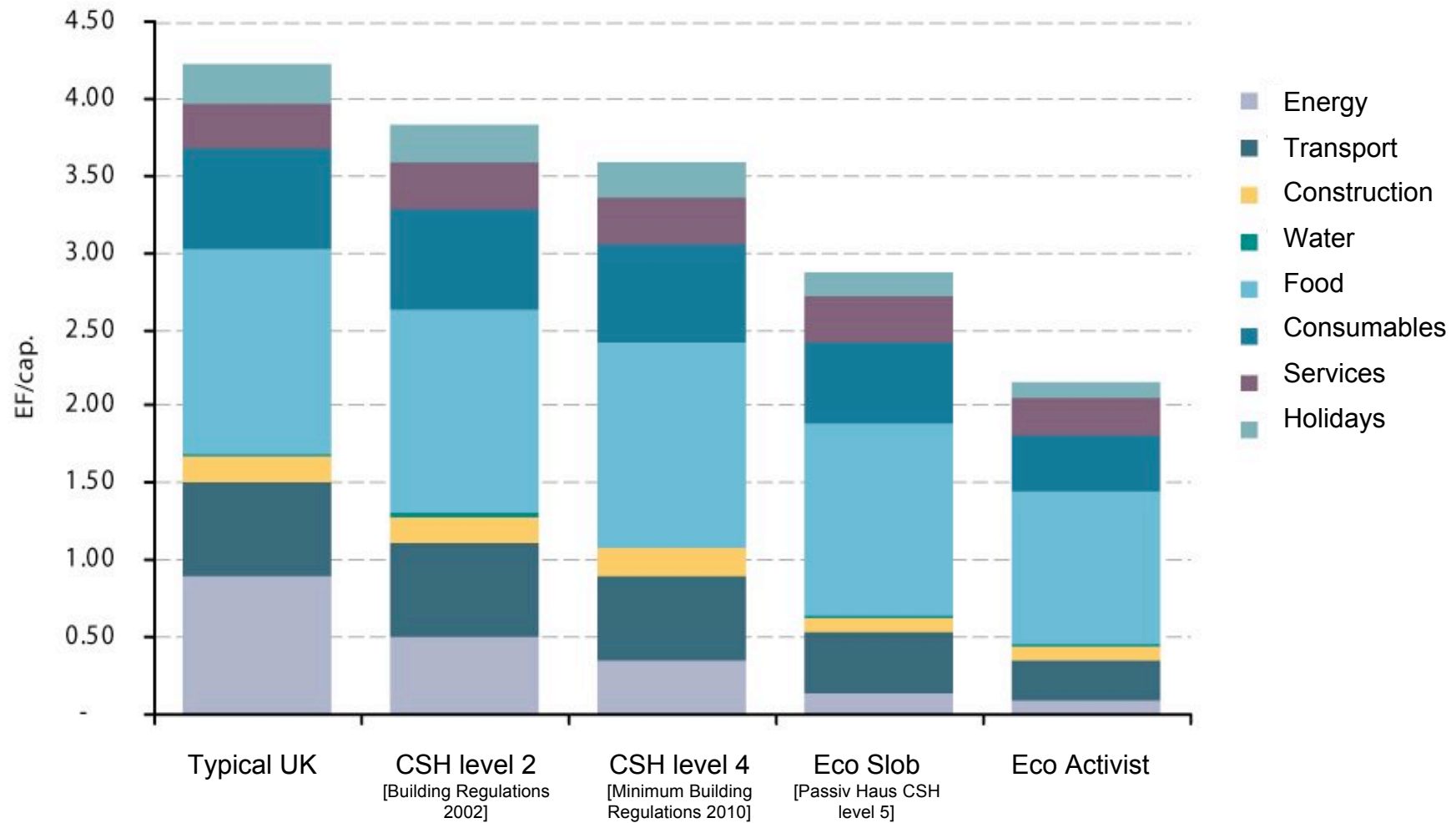
Technical Guide



www.communities.gov.uk
community. opportunity. prosperity



Planning Guidance



[An analysis of four different UK housing types and the associated Ecological Footprint of the residents, combining the indirect impacts of consumption, including the impact of construction – ARUP / SEI 2006]



“... we are learning a lot, which is the whole purpose of the Challenge. The best work is being taken by developers who are taking an open approach, sharing mistakes and successes.”

Lomas, Jane [September 2008] Carbon Challenge: Testing Level 6. *Carbon Challenge Bulletin*, English Partnerships.



1. Greenwich Millennium Village, London and Thames Gateway
2. William Berry / Weber-Haus and Moka Architects' design for the Aylesbury Design for Manufacture site
3. Start on site at Oxted Park Design for Manufacture site, Milton Keynes by George Wimpey

The Carbon Challenge

The challenge to build quality sustainable homes

to accelerate the housing industry's response to change by fast-tracking the creation of a number of zero and near zero carbon communities. The key objective is to raise the environmental performance of new communities while still delivering quality and high standards of design.

The Challenge aims to equip the development industry with the skills and technology needed to meet the 10-year environmental goals being set by Government for new housing development. In particular, it will act as a testing ground for the Government's Code for Sustainable Homes and the new Planning Policy Statement on climate change.

Run by national regeneration agency English Partnerships on behalf of Communities and Local Government, the Challenge will be a successor to the Design for Manufacture Competition, which successfully demonstrated how to build sustainable well-designed, affordable, quality homes.

What is a zero and near zero carbon development?

Zero carbon means no net carbon emissions from all energy uses in the home – so the amount of energy taken from the national grid is less than or equal to the amount put back through renewable technologies. This equates to Level 6 of the Code for Sustainable Homes and will qualify for Stamp Duty relief.

Near zero carbon means no net carbon emissions in relation to core Building Regulations energy performance specifications relating to heating, hot water, ventilation and lighting. This equates to Level 5 of the Code for Sustainable Homes.

The choice of a zero or near zero carbon target for any development depends on location, site characteristics and size of the community.

How many homes are being created and where?

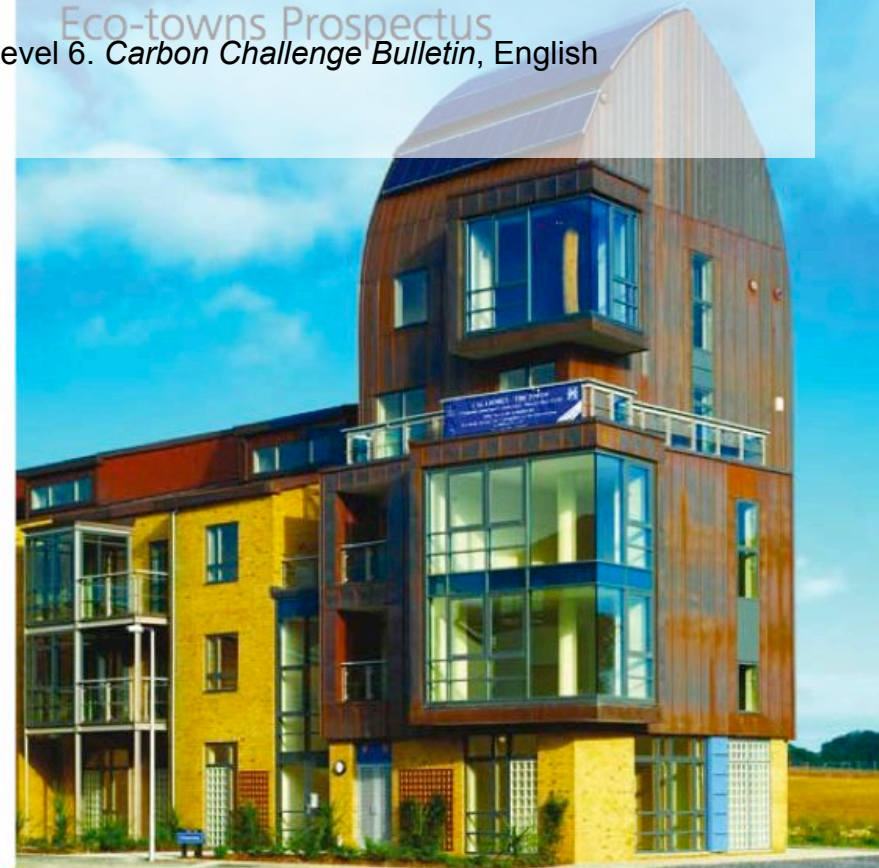
The Carbon Challenge will be an on-going initiative with development sites coming on stream throughout the programme. In addition to sites that English Partnerships will make available directly to developers, the Challenge will also call for local authorities, Regional Development Agencies (RDAs), other public-sector land owners and private-sector developers to identify sites that could contribute to the initiative. Those taking part in the Challenge will be right at the forefront of implementing and shaping the way that homes of the future are built.

In the first year of the Challenge, it is expected that a total of around five major public and private-sector sites will be identified. Each must be capable of supporting at least 200 homes to ensure a critical mass, allowing the installation of shared energy systems and other features that will contribute to a zero or near zero carbon footprint to each new settlement.

www.englishpartnerships.co.uk/carbonchallenge



Eco-towns Prospectus



www.communities.gov.uk
community, opportunity, prosperity

“Cities and suburbs are vast and varied laboratories of trial and error, natural wealths of information and potential information, from which we can take more useful knowledge than we commonly do”

Jacobs, Jane [2001] “Random Comments”. *Boston College Environmental Affairs Law Review* [28]4 Summer pp 537-545. Part of a 40th anniversary review of the publication of Jacobs, Jane [1961] *The Life and Death of Great American Cities*.

“Without diversity, without weirdness, without difference, without tolerance, **a city will die**. ... Cities don’t need shopping malls and convention centres to be economically successful, they need eccentric and creative people”

Florida, Richard [2002] *The Rise of the Creative Class*.

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content rises.
solution to
fill theaters,
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Sociology
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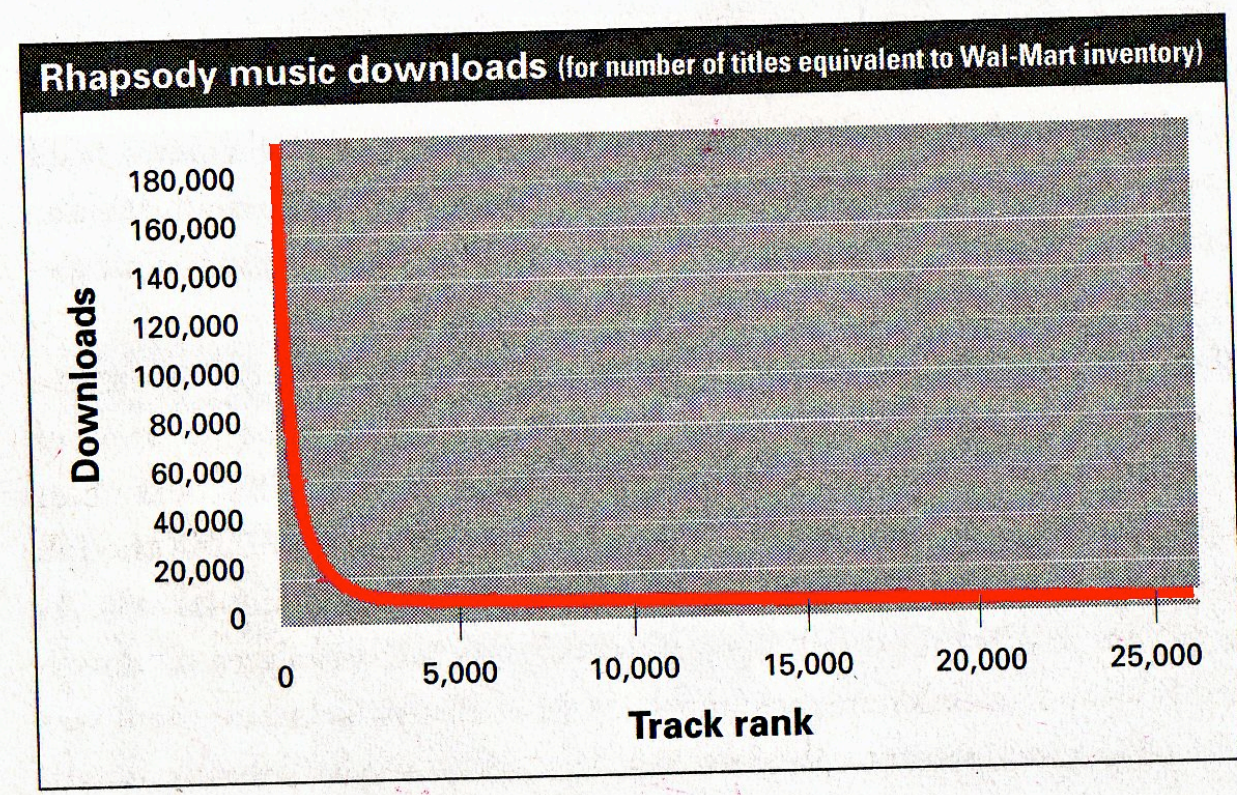
epth in later
asn't enough
space for all
gh screens to
adcast all the
music created;
ze everything

“The mass market is turning into a mass of niches”

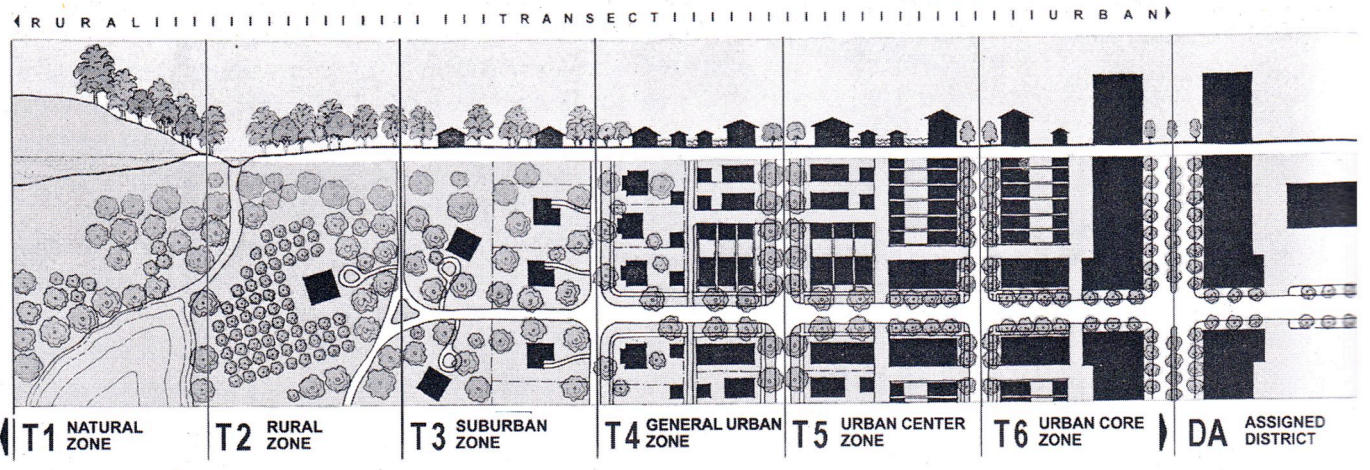
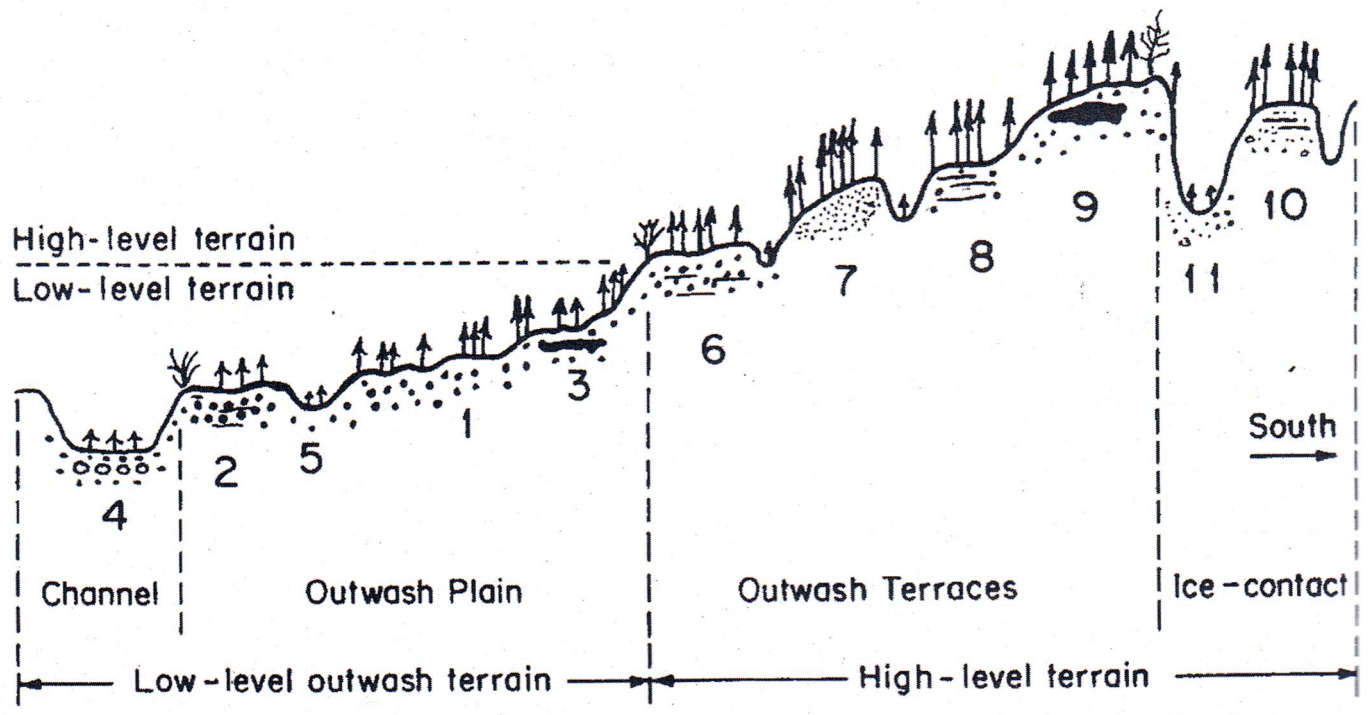
Anderson, Chris [2006] *The Long Tail: How endless choice is creating unlimited demand* [Random House, London].

music retailer Rhapsody. A subscription-based streaming service owned by RealNetworks, Rhapsody currently offers more than 1.5 million tracks.

Chart Rhapsody's monthly statistics and you get a demand curve that looks much like any record store's: huge appeal for the top tracks, tailing off quickly for less popular ones. Figure 1 graph representing the top 25,000 tracks downloaded via Rhapsody in December 2005.

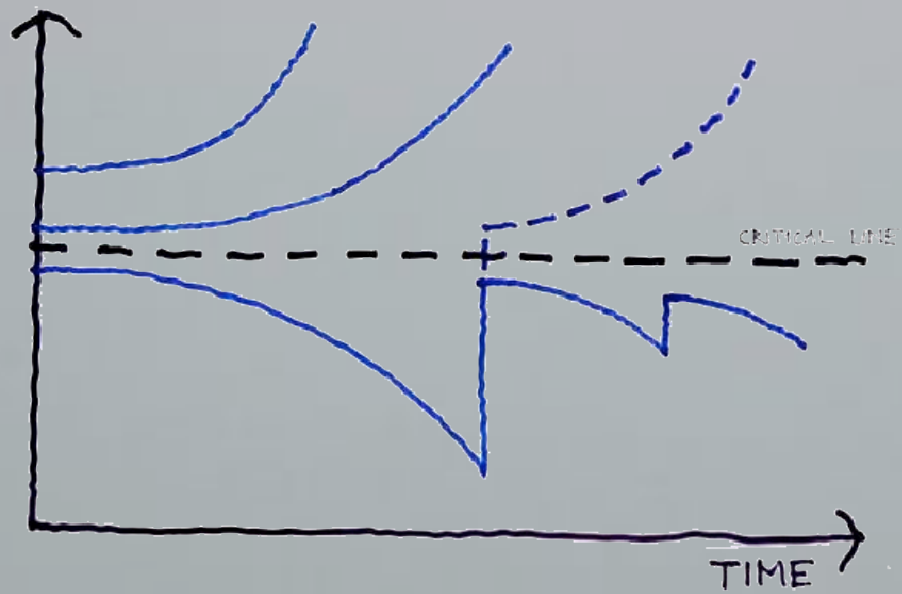


The first thing you might notice is that all the action appears to be concentrated on the left-hand side. No surprise there.

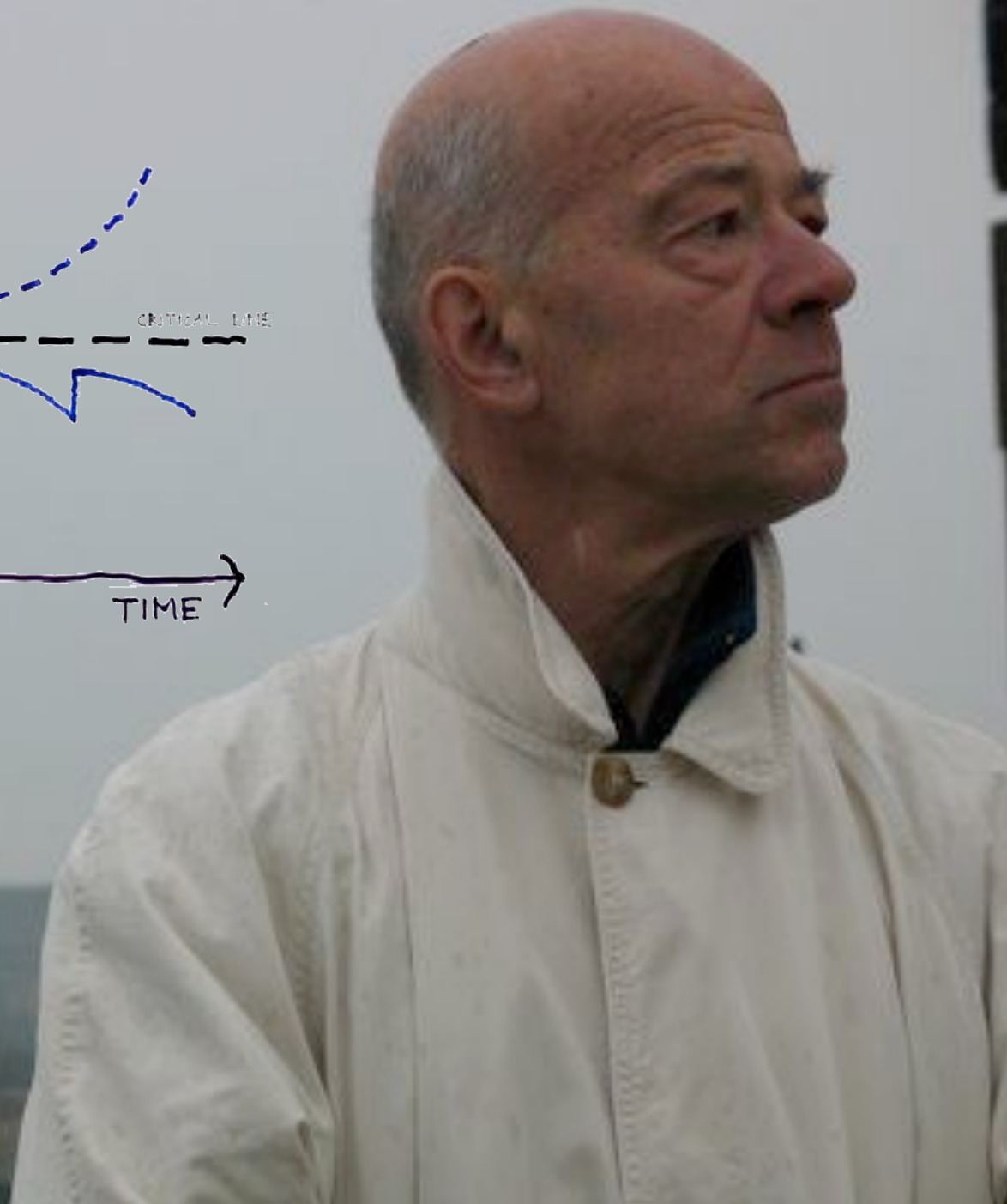


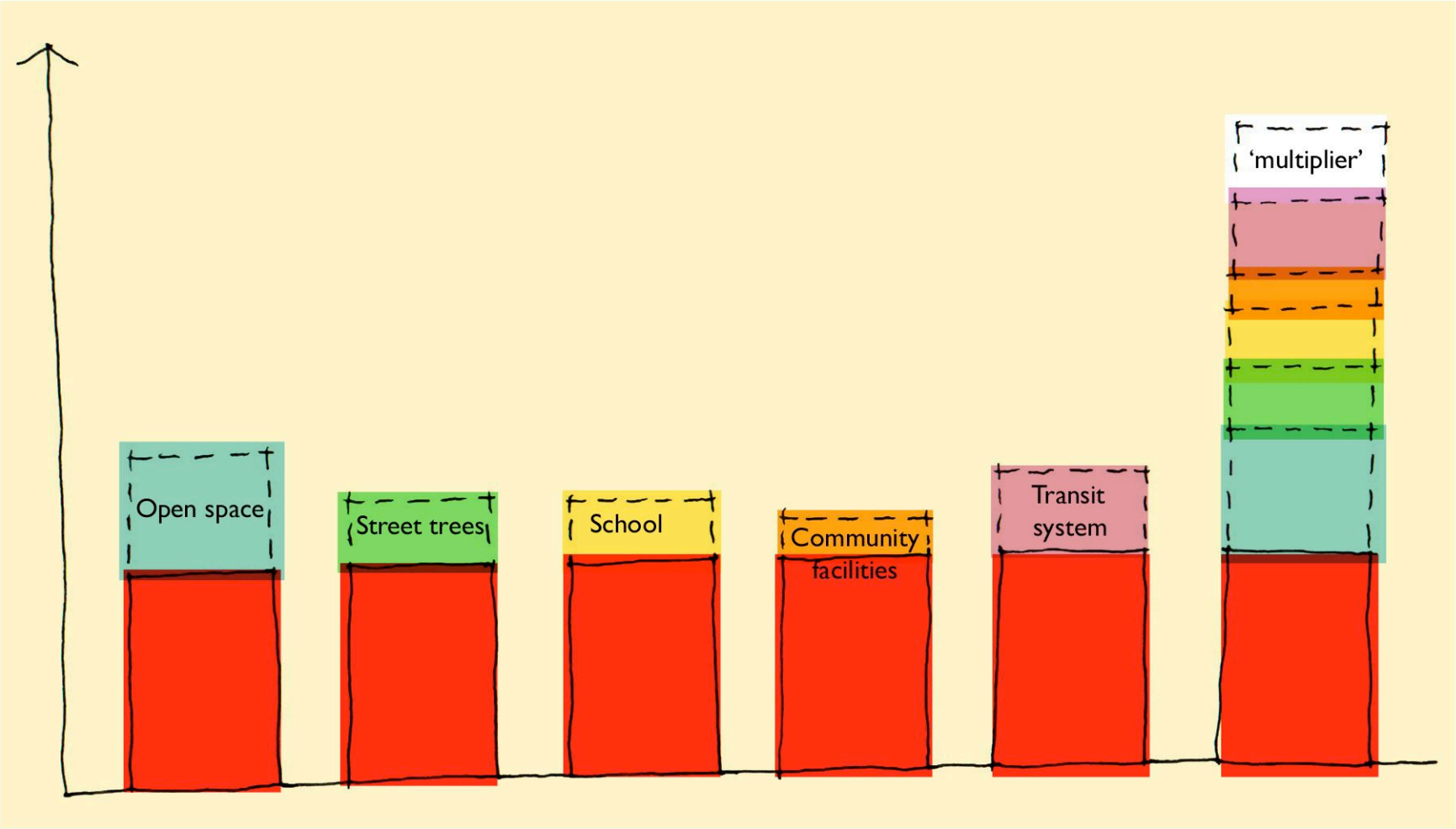
Ecological transect [Barnes, B.V] and Urban-Rural Transect . Image form Duany Plater-Zyberk.

MARKET
VALUE



Prof. Klas Tham





30 Jahre Europäische Stadt - Rückblick und Ausb

Internationaler Kongress d
Council for European Urba
8. bis 10. September 2005



30 Jahre Europäische Stadt
Rückblick und Ausblick
Internationaler Kongress der
Council for European Urban
8. bis 10. September 2005



pPODIA



Peterboroughness¹ |'pētər| |'bərō|(abbr.: **bor.**) |nəs; nis|

adjective

1 the fact of quality (of a person) of being from Peterborough; resemblance of the city (of the place) : *Andy Bell's flamboyance and dress sense shows the characteristic of Peterboroughness* | *there is a real Peterboroughness on the South Bank and the proximity to the river Nene*. See notes on

Peterborough [proper noun] and **Peterborian**.

2 having a slightly confused regional identity – evident in the uncertainty over the use of 'East' in geographical descriptions resulting in misconceptions of where it is situated within a strategic context: *Peterboroughness is based in **East** Anglia* (blamed on the University), *or is it **East** of England or the South **East** or the **East** Midlands?*

3 noticeable for being flat | lying below sea level | having characteristic man-made drainage systems (Fens and Dykes): *this Fenland landscape suggests we are close to Peterborough*.

4 an exemplar for cultural diversity within the typical smaller English city (the cosmopolitan mix of communities contrasting with the city still being perceived as a 'market' or 'new' town): *the many generations of migrants have created a real positive Peterboroughness about the town*.

5 an exemplar for architectural diversity within the typical smaller English city (resulting from a large number of small scale local and speculative developments set within a distinctive and controlled Cartesian morphology): *the competition between local builders on this single street and the heterogeneity over the external appearance of buildings has given the place Peterboroughness*.

5 having a quiet spirituality (supposedly resulting from the tolerance for the above diversity).

6 reflecting the local geology (Barnack Stone | Ancharter Limestone | Greensand) and reminiscent of (Blue Oxford) clay pipes and bricks, specifically within the Fletton area : *the home of the London Brick Company is evident through the Peterboroughness of the Phorpres bricks*.

7 punching above your weight (usually in context of football giant-killing).

8 related to food production and processing (adding value to apples, plum).

[predic.] (**Posh on**) having the visible appearance and characteristics of Peterborough (feeling down at heart or flat) : *Warren has a real Posh on today*.

DERIVATIVES

Posh |pə sh| informal noun

ORIGIN Old English *burg, burh* [fortress, citadel,] later [fortified town,] of (Durobrivae) Roman and later Germanic origin; related to Dutch **burg** and German **Burg**. Compare with **burgh** but not Chris de (not as sometimes suggested the long lost brother of Peter).

Peterborough |'pētər| |'bərō|

a city, town or borough and railway hub / river port in east-ish (subjective geography) of England, situated at the junction of the Nene River, the Great North Road (London Road) and the East Coast mainline railway (mostly London Railway); pop. 180,000. Also known as "Medeshamstede" (Saxon Settlement in the Meadow), 'Gildenburgh' (Golden Borough historical derivative of 'Posh') and 'Pizzaborough' (resulting from early 20th Century Italian immigration to the Fletton brickfields).

Non-architects have berated the ... “failure for design processes to become consumer led and better informed by the emerging needs of the customer. It is often difficult to persuade companies in this sector to invest in the creation and application of social and consumer insights ... [t]he hope is that this type of sociologically-based thinking”.

Howard, Melanie [2007] The homes that the future built in the introductory essay to the 2007 Housing Design Awards



Peterborough Dolls

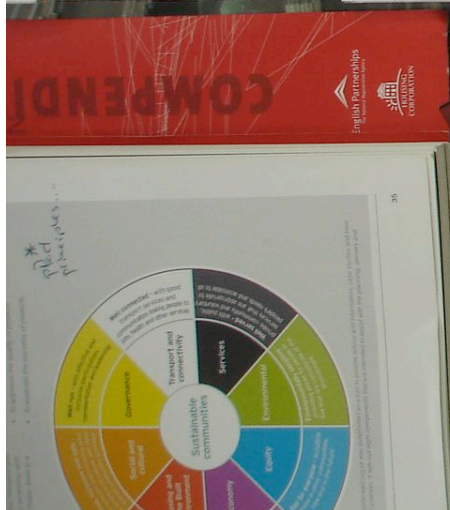
Sarah is a professional journalist who has worked in the city since her graduation, over ten years ago.

She has developed an interest in the housing offers for the single professional female following a successful series of articles she penned for *Woman and Home*. This highlighted the subtle gender imbalances in some locations where there is a higher number of service and creative jobs – an example being her own profession that is 57% female. She feels there should be recognition of the growth of single women entering the property market independently of husbands and partners. She thinks this is a trend that will raise the profile of sustainable design as her work unearthed research showing women are significantly more aware of environmental issues and the links with climate change. She even anticipates her employer publishing a carbon-free version of *heat* at some point in the future in response to this.

Her cultural references are 'loose women' mixed with 'Ali McBeal'.



... playing the Peterborough Game



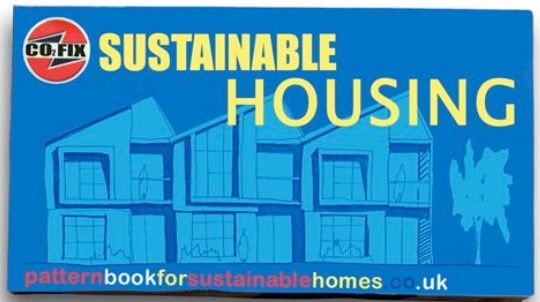
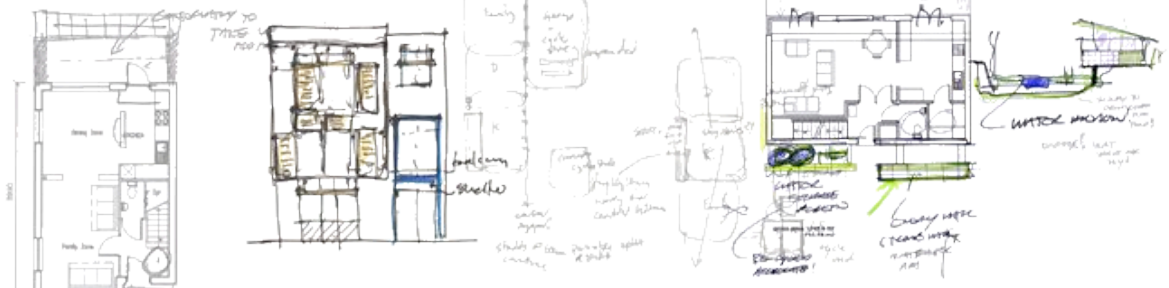
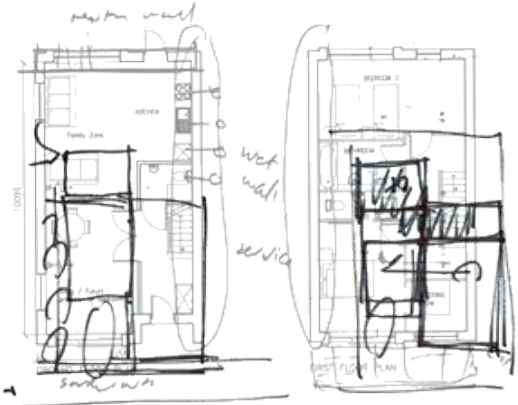
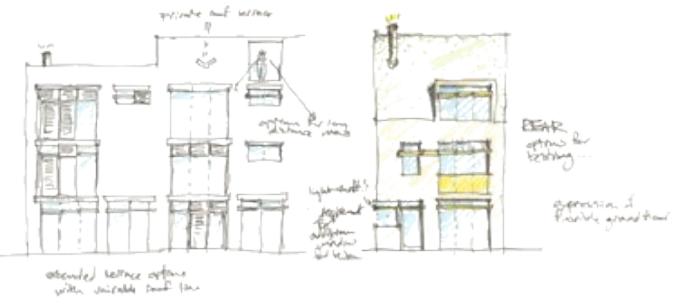
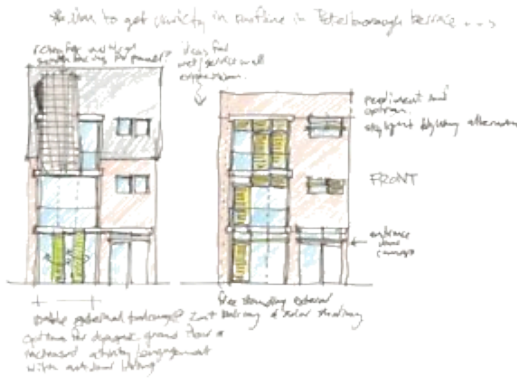
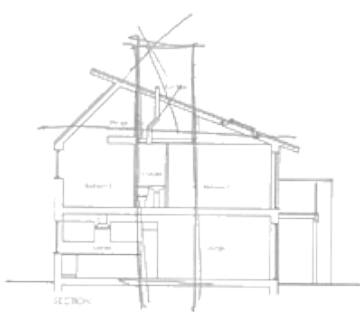
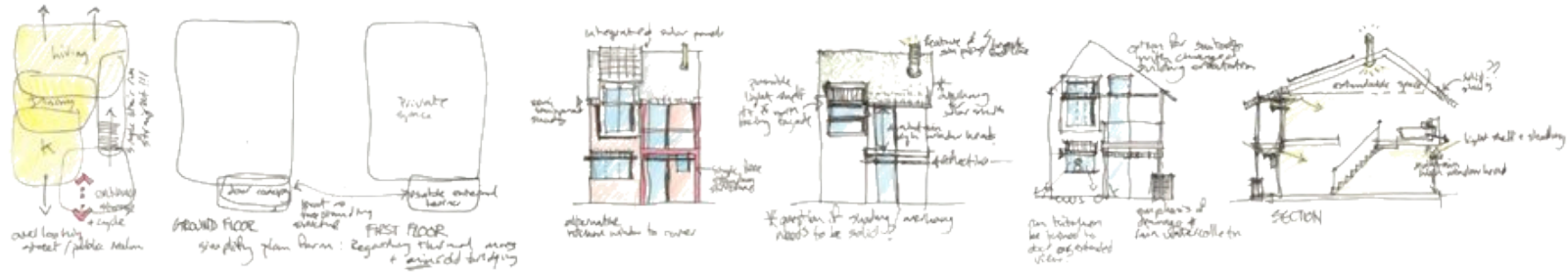
... link to www.inspire-east.org.uk

... playing the Peterborough Game

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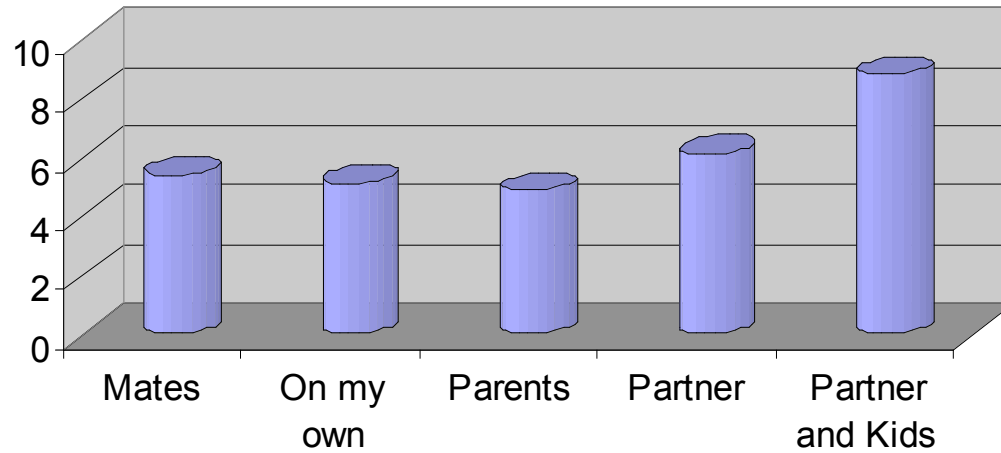
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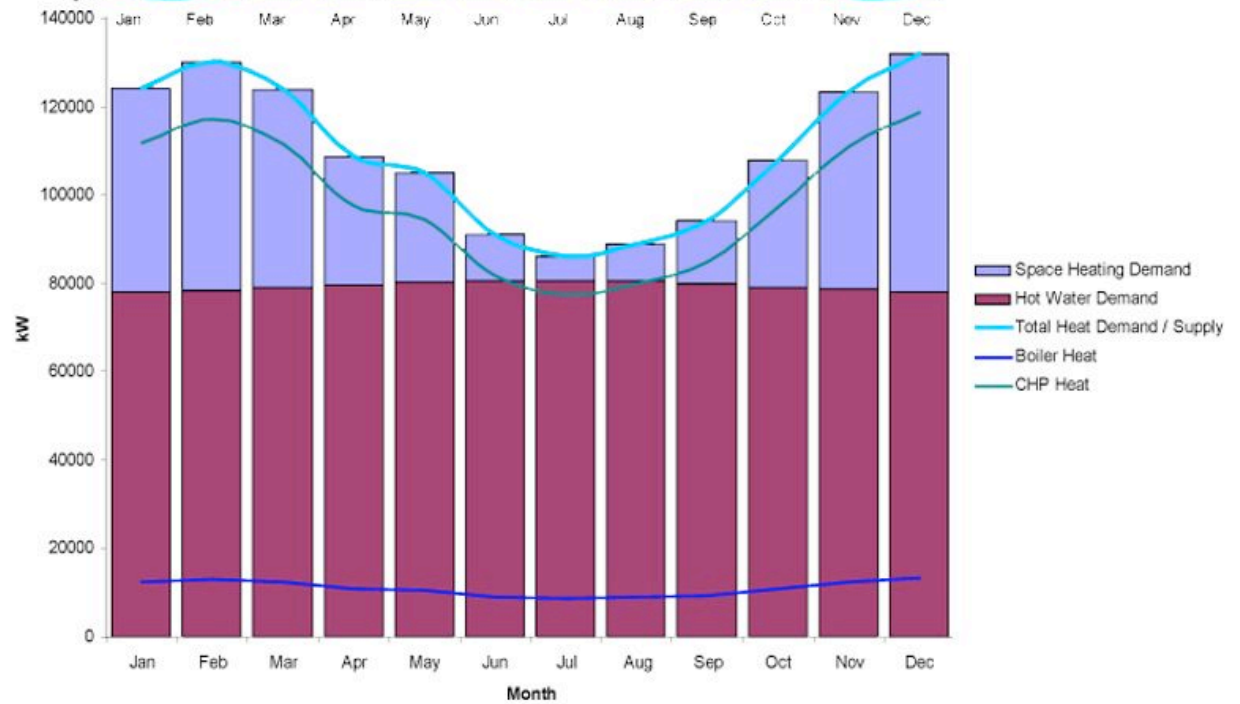
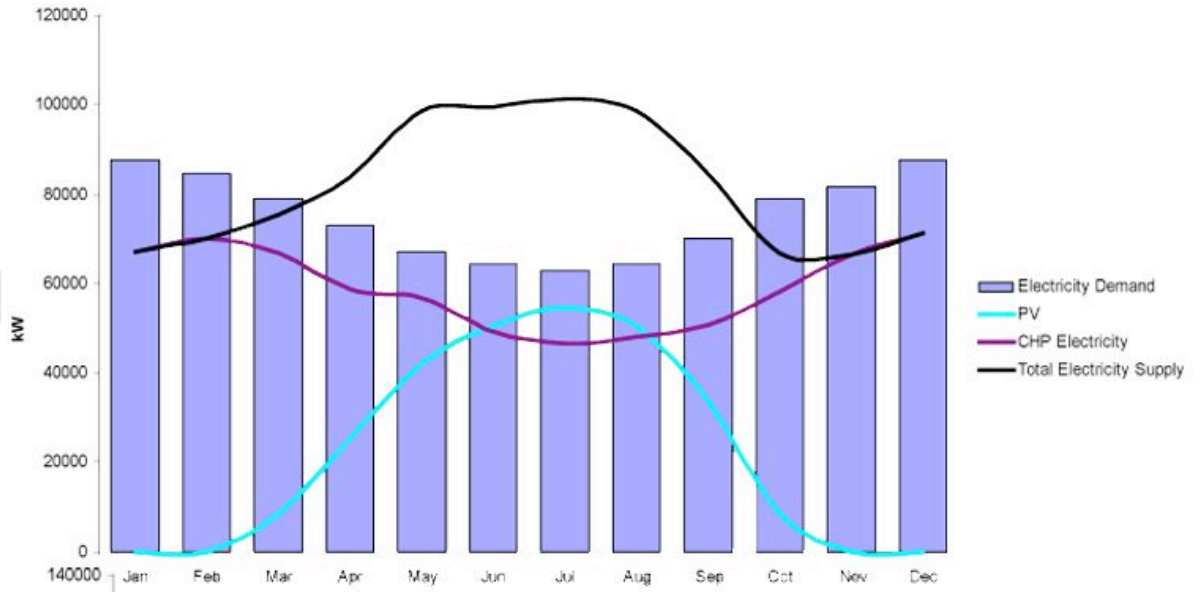
Average Carbon Footprint [Tonnes]



Microsoft Excel - final analysis

	A	AM	AN	AO	AP	AQ	AR	AS	BB
		How do you travel for journeys less than a mile?	How many short haul return flights do you take every year?	How many long haul return flights do you take every year?					
1									
2	2	public transport	1 to 2	1 to 2	5.95				
3	3	walking/cycling	1 to 2	none	6.82			male	
4	4	walking/cycling	none	none	3.3		63	7.98	48%
5	5	walking/cycling	none	none	3				
6	6	walking/cycling	3 to 5	1 to 2	6.57			female	
7	7	walking/cycling	none	1 to 2	12.92		67	6.69	52%
8	11	walking/cycling	1 to 2	1 to 2	5.57		130	8	
9	12	walking/cycling	1 to 2	3 to 5	9.43				
10	14	walking/cycling	none	none	4.18				
11	15	walking/cycling	none	none	2.72				
12	19	walking/cycling	3 to 5	1 to 2	9.29				
13	20	walking/cycling	1 to 2	none	3.61		age	21-35	
14	21	walking/cycling	1 to 2	1 to 2	5.51		89	7.08	68%
15	23	walking/cycling	1 to 2	none	6.45				
16	24	walking/cycling	1 to 2	none	4.82		age	36-50	
17	25	walking/cycling	1 to 2	none	9.46		22	6.76	17%
18	26	walking/cycling	3 to 5	none	3.59				
19	28	walking/cycling	none	none	4.41		age	51+	

	A	B	C	D	E	F	G
		Commuting comments	Spare time activities	Weekend activities	Community comments	Housing preferences	Environmenta
1	No.		Spends time with family. Gathering with friends for dinner parties etc.	4			
2	1				Wants a close community feel so she can feel safe about her child (babysitting etc.), also would like to be involved in community.		Aware of enviro issues
3	2				Children's time very much important therefore close community required. Too much work therefore cannot be involved in community, but would like to, although not much community feel in flats.	All live together. Money is the problem keeping them from moving into "proper" accommodation.	
4	3			2	Looking for a close community with values, safe but also offers privacy for family. Involvement within community minimal, would likely stay that way after move because of close knit family.	Wants large house for grandchildren. Probably will live with one of her kids.	Environmental is really play a part making, but if all available in hor would be a plus
5	4				Likes open spaces with gardens etc. doesn't like living in flat, but moving into house no an option at this age. Small community atmosphere in retirement complex, everyone quite close.		
6	5		Takes part in retirement home activities (outings to parks, coast, crafts etc.)				
7	6			Likes to go to clubs on weekends. Booze, drugs etc. (serious but likes to have fun).	Wants a community with young people; professional, but still know how to have fun.		Environmentally
8	7	Bus. Wants better access to public transport, in addition to an increase in quality of public transport.			Very much involved within polish community helping with polish get togethers, charity etc. but not a much interaction with non-polos although he would like to.		
9	8				Worried about cultural influence on child. Want a close community (dearly). Something where they could really get involved and get to know neighbours so they can feel safe about their child.		
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"Lack of green spaces. Does voluntary work on community projects."

"Wants more playgrounds for children, and more leisure opportunities for young families. Also wants safer street for public, especially in the evenings. Afraid to be in the city at night. Wants more polices on the street"

"Wants more parks for children. Active in the muslim community"

"Wants more walkable community. Wants to see more green spaces and waste bins"

"Wants more green spaces for families"

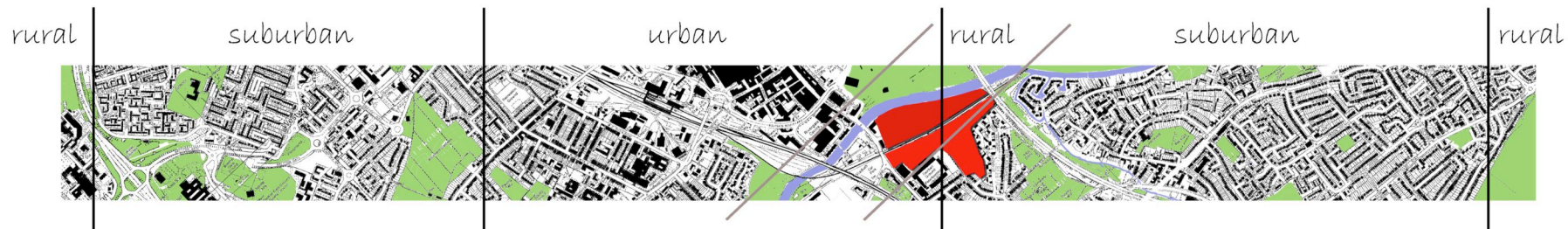
"Wants to see less cars and more green spaces in the city"

"Involved as a scout leader and in the local church. Believes there is a strong community locally based around the church. Would like to see more play areas for young children"



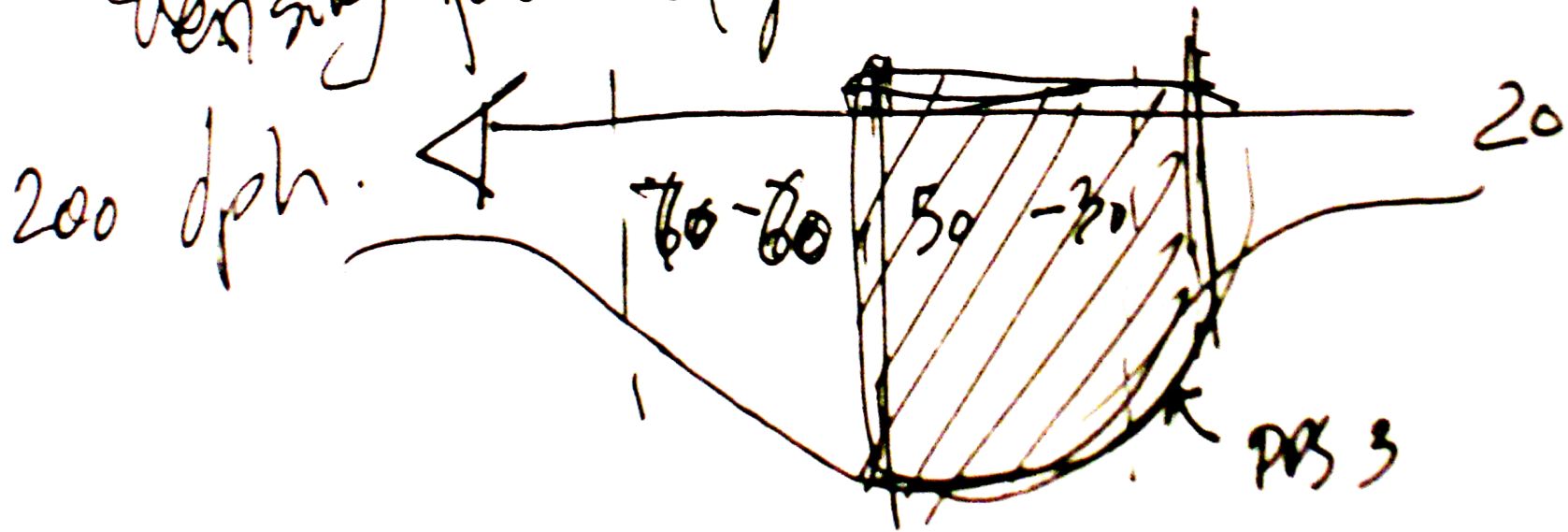
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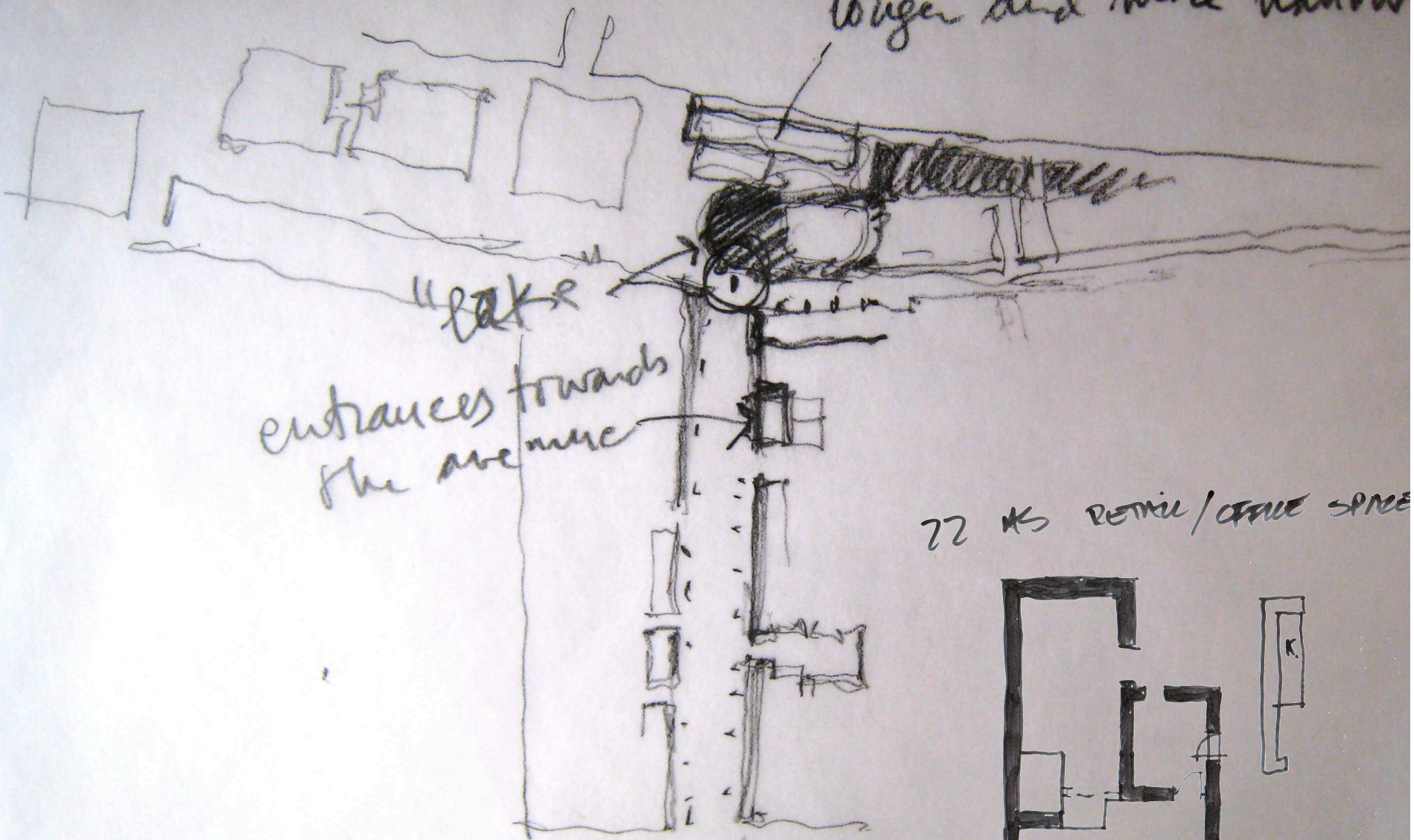


issues for new sustainable urbanism

density profile (gradient transect)

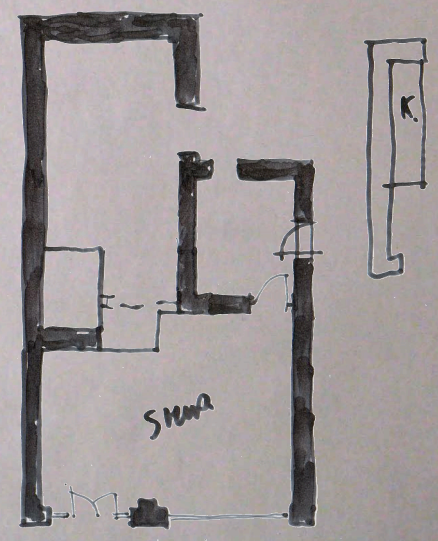
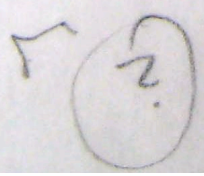


longer and more narrow



entrances towards the avenue

72 RS RETAIL / OFFICE SPACE





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