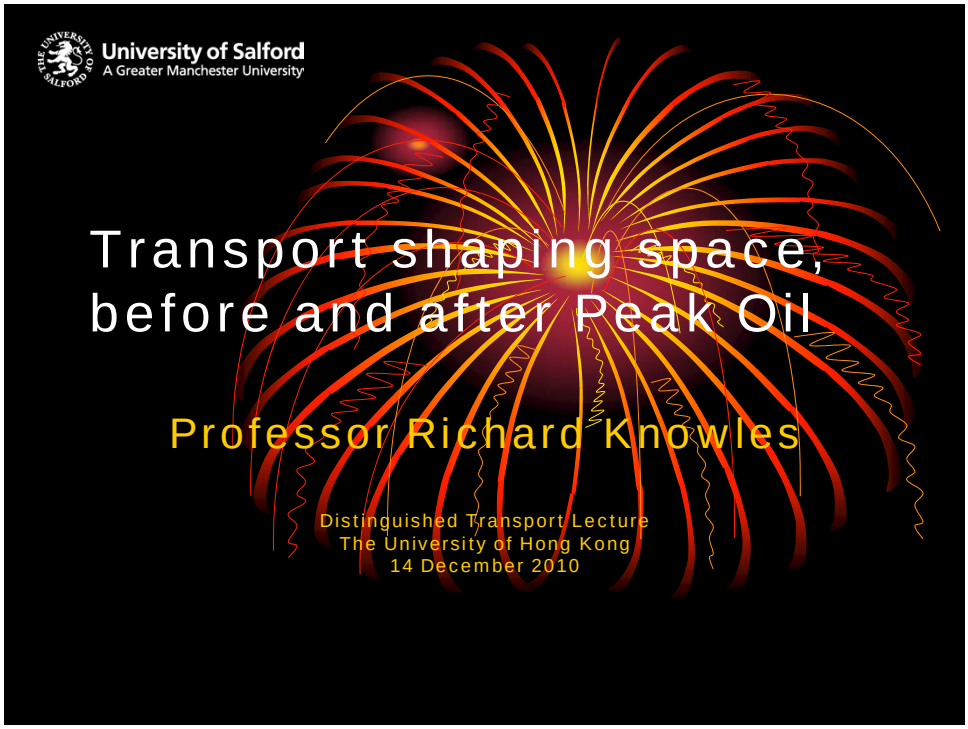

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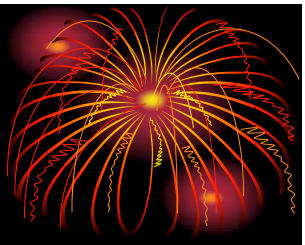

However, *relative* disparities in transport time and cost have widened between areas

Transport helps to shape spatial patterns of development

Location remains all-important as space-time relationships collapse differentially

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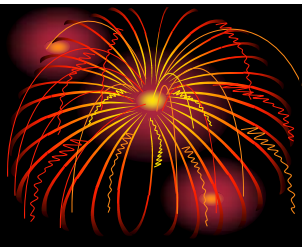

Access to transport remains unequal both within and between areas restricted by:

- personal income
- age
- gender
- disability

as well as by location

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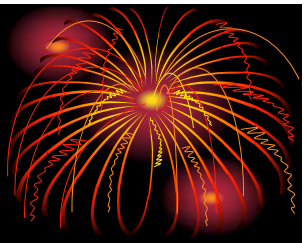

This lecture considers:

- the differential collapse in time-space and cost-space resulting from successive transport innovations
- historical impacts of faster and cheaper transport on spatial development at different spatial scales
- consequences of Peak Oil and the end of cheap oil

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Industrialisation, transport mechanisation and time-space convergence

1. Inland barge canals
2. Steam powered railways
3. Accurate navigation – longitude: Harrison's Chronometer patented in 1773 but 50 years before in widespread use
4. Faster and more reliable trading by sailing ships: Maury's pilot charts and maps of ocean winds and currents for the Atlantic, Pacific & Indian Oceans between 1842 and 1861

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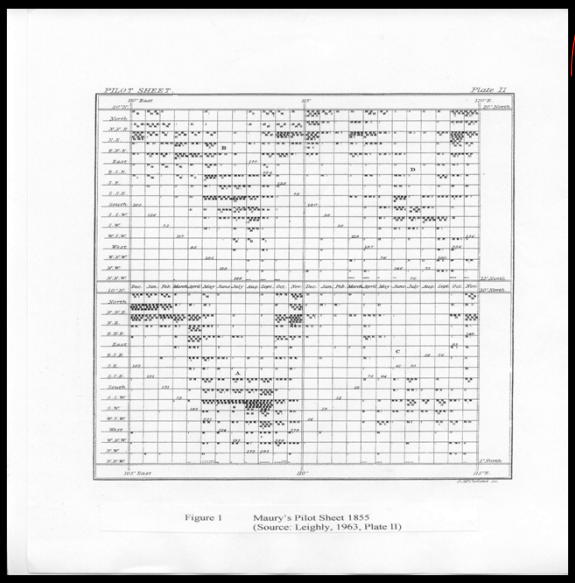

Figure 1 Maury's Pilot Sheet 1855
(Source: Leighly, 1963, Plate II)

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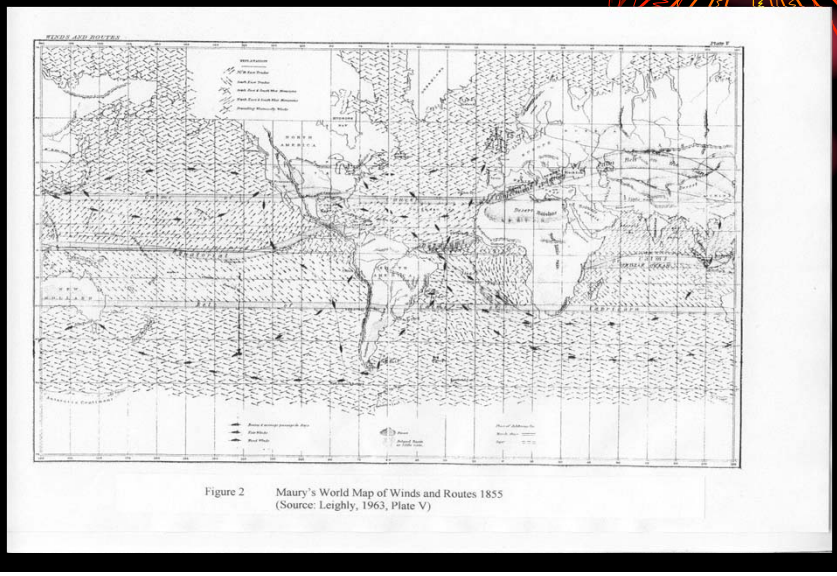

Figure 2 Maury's World Map of Winds and Routes 1855
(Source: Leighly, 1963, Plate V)

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5. Telegraph and telephone
6. National, trans-continental and inter-continental transport : steam railways and iron steamships
7. Strategic Ship Canals:
   Suez, Panama & Kiel
8. Growth of world trade:
   1800: 3% of world output
   1913: 33% of world output

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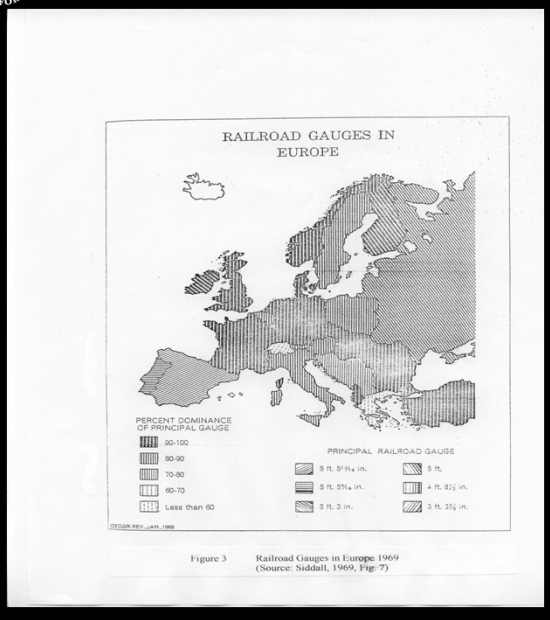

Figure 3 Railroad Gauges in Europe 1969 (Source: Siddall, 1969, Fig. 7)

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Uneven convergence of time-space and cost-space

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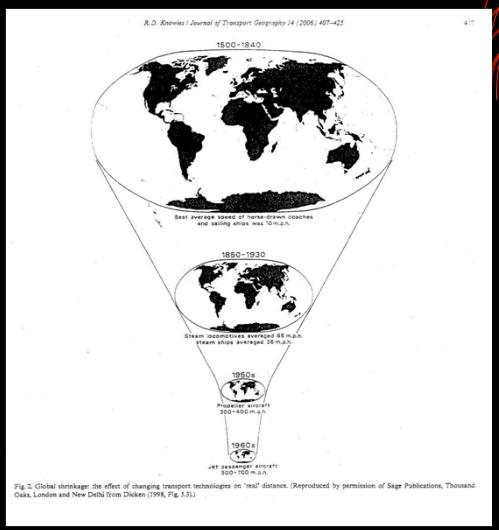

Fig. 2. Global shrinkage: the effect of changing transport technologies on 'real' distance. (Reproduced by permission of Sage Publications, Thousand Oaks, London and New Delhi from Dicken (1998, Fig. 5.3).)

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Representation of transport & land use in models of urban structure

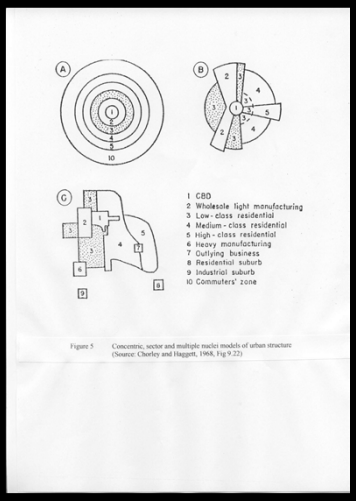

Figure 5 Concentric, sector and multiple nuclei models of urban structure (Source: Chorley and Haggett, 1968, Fig 9.22)

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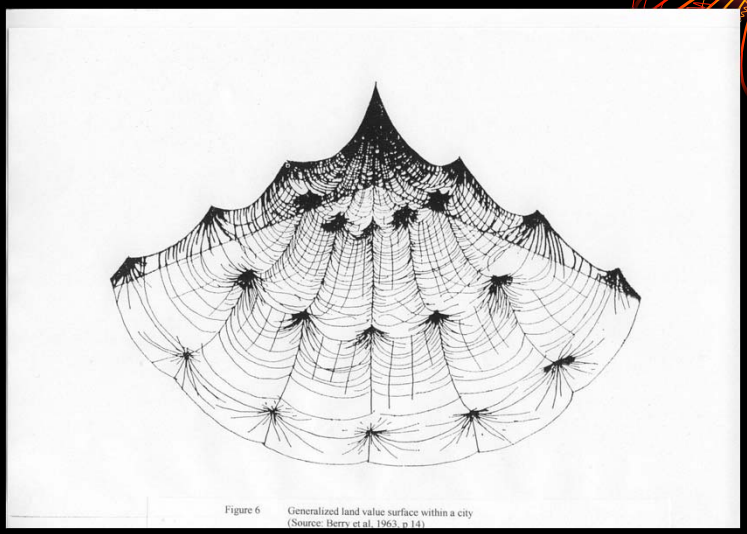

Figure 6 Generalized land value surface within a city (Source: Berry et al, 1963, p 14)

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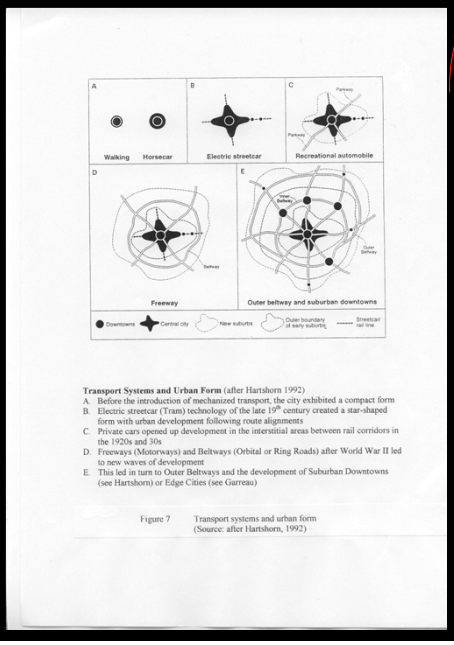

Transport Systems and Urban Form (after Hartshorn 1992)

A. Before the introduction of mechanized transport, the city exhibited a compact form
B. Electric streetcar (Tram) technology of the late 19th century created a star-shaped form with urban development following route alignments
C. Private cars opened up development in the interstitial areas between rail corridors in the 1920s and 30s
D. Freeways (Motorways) and Beltways (Orbital or Ring Roads) after World War II led to new waves of development
E. This led in turn to Outer Beltways and the development of Suburban Downtowns (see Hartshorn) or Edge Cities (see Garreau)

Figure 7 Transport systems and urban form (Source: after Hartshorn, 1992)

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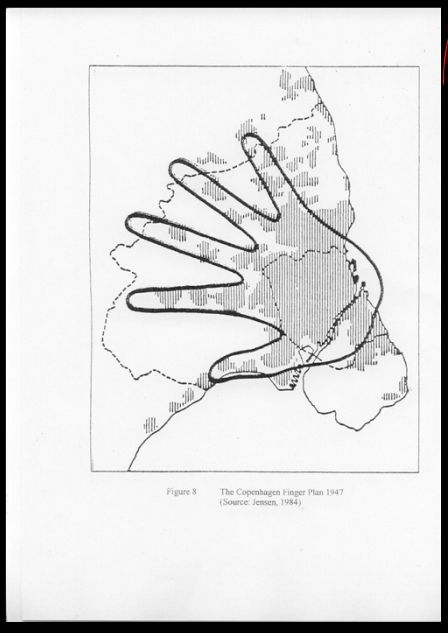

Figure 8 The Copenhagen Finger Plan 1947 (Source: Jensen, 1984)

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Misrepresentation of transport costs in classic locational models

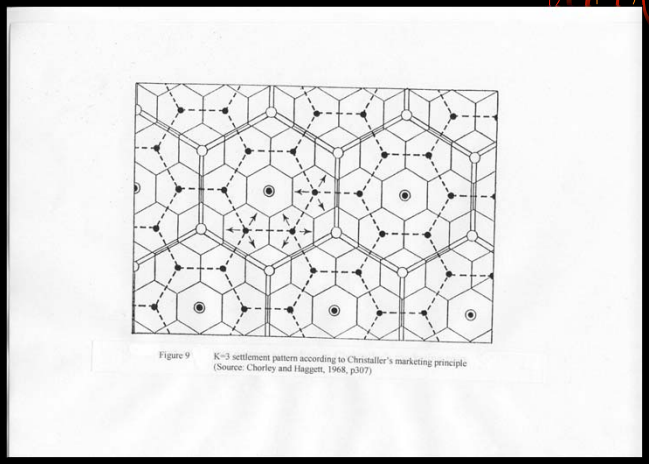

Figure 9 K=3 settlement pattern according to Christaller's marketing principle (Source: Chorley and Haggett, 1968, p307)

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20th century developments in transport technology

1. Motorised road transport :
   - cheap over short distances and flexible
   - limited access highways: speed & traffic volume
   - cars widen the choice of residential sites
   - mass car ownership enables dispersal of 'activity' sites

2. Air transport: expensive but fast
   - Propeller: 500 -600kph
   - Jet: 900kph
   - Supersonic: 2400kph (Concorde 1975-2003)

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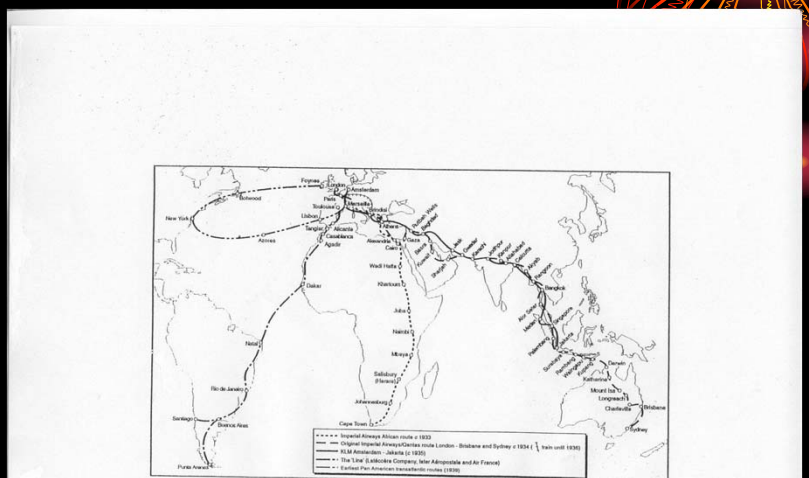

Figure 10 Some major pioneering intercontinental air routes
(Source: Graham, 1995, Fig.1.1)

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3. Cheaper Bulk shipping:
   - oil
   - grain
   - coal
   - gas
   - metal ores

4. Containerisation, lower handling costs & intermodal transport

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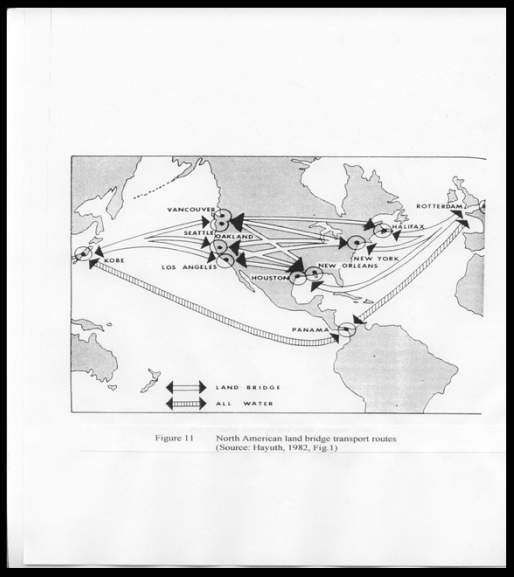

Figure 11 North American land bridge transport routes
(Source: Hayuth, 1982, Fig.1)

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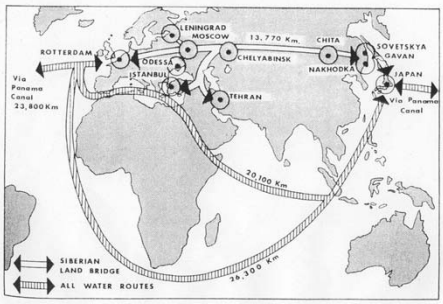

Figure 13 Trans-Siberian land bridge transport routes
(Source: Hayuth, 1982, Fig.3)

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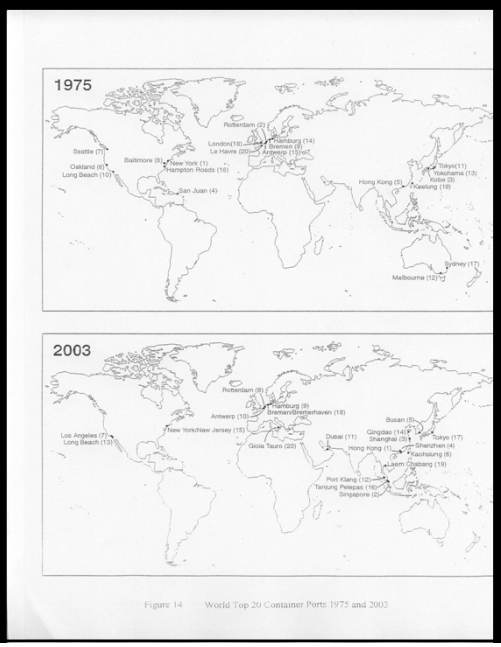

Figure 14 World Top 20 Container Ports 1975 and 2003

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5. Roll-on roll-off ferries

6. Fixed links (bridges & tunnels)

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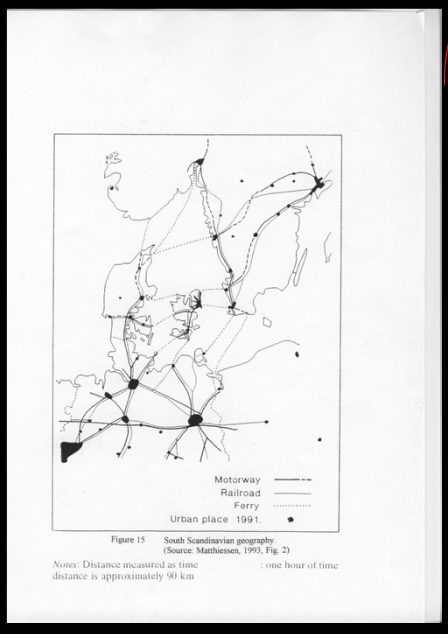

Figure 15 South Scandinavian geography
(Source: Matthiessen, 1993, Fig. 2)

Notes: Distance measured as time : one hour of time distance is approximately 90 km

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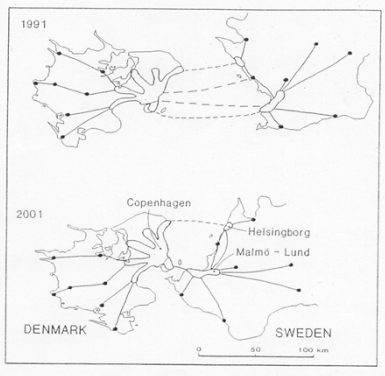

Figure 16 Copenhagen and Malmö-Lund: pre and post bridge situation
(Source: Matthiessen, 1993, Fig. 3)

Note: Time distance indicated; urban areas delimited; dotted lines = ferry services

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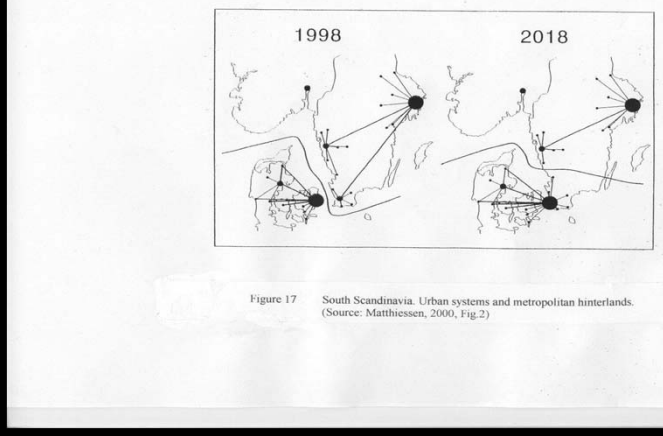

Figure 17 South Scandinavia. Urban systems and metropolitan hinterlands. (Source: Matthiessen, 2000, Fig.2)

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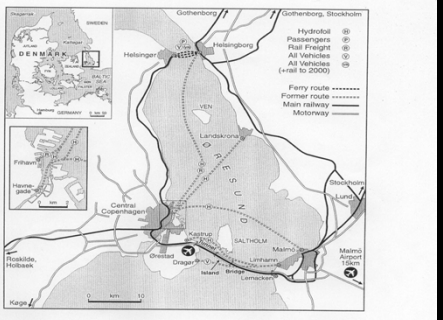

Figure 18 Trans-Øresund Transport Routes (Source: Knowles, 2004)

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7. High speed trains (HST): >300 kph
- compete with air transport up to c640km
- locational advantages for HST cities

8. Telecommunications:
- teleworking & internet shopping: growing but still small scale
- 'death of distance' (Cairncross, 2001) mistaken: personal transport continues to grow

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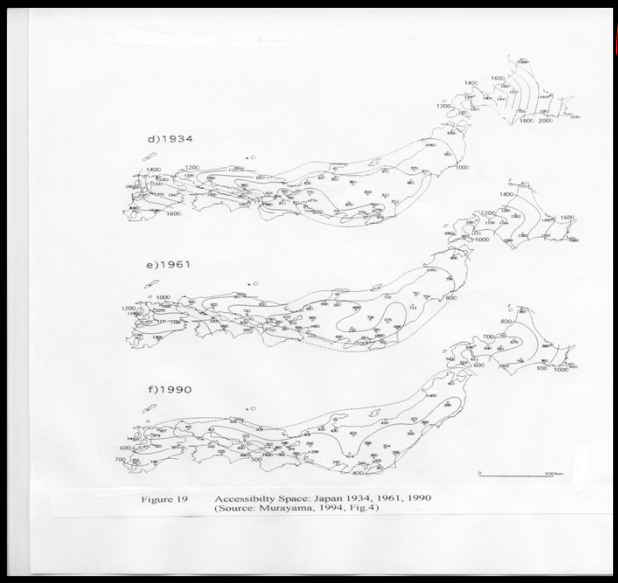

Figure 19 Accessibility Space: Japan 1934, 1961, 1990 (Source: Murayama, 1994, Fig.4)

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Privatisation, deregulation, 'hub and spoke' networks and the importance of 'intermediate' locations

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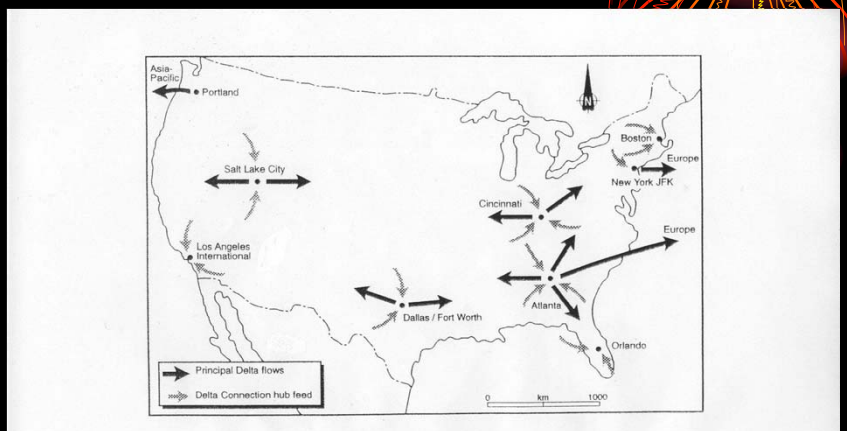

Figure 21 Delta Air Lines hub and spoke system, 1994
(Source: Graham, 1995, Fig. 6.3)

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This shrunken, misshapen world

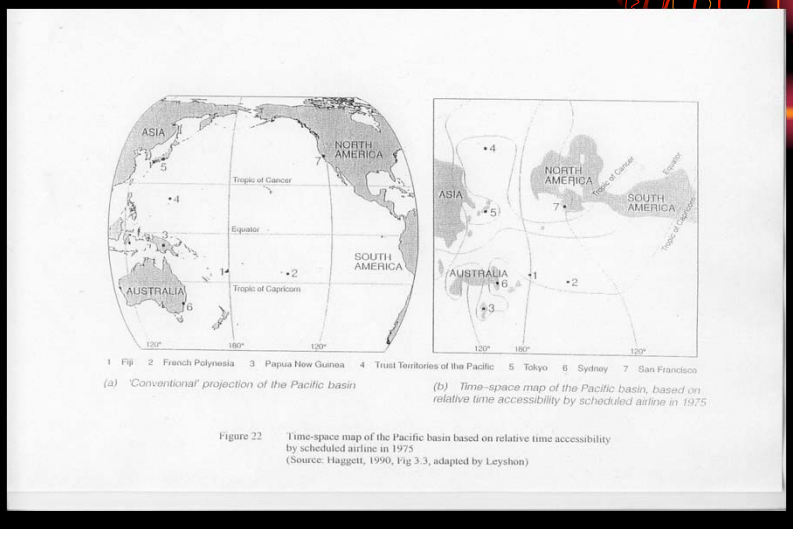

Figure 22 Time-space map of the Pacific basin based on relative time accessibility by scheduled airline in 1975
(Source: Haggett, 1990, Fig 3.3, adapted by Leyshon)

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‘Peak Oil’ & the end of ‘cheap oil’

Oil is a finite, non-renewable resource which powers >95% of transport

‘Peak Oil’ : when maximum global production is reached followed by terminal decline.

Strong global concern over carbon emissions but the fast approaching crisis of Peak Oil and dear oil has received little attention

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Theory of Oil crisis- Hubbert

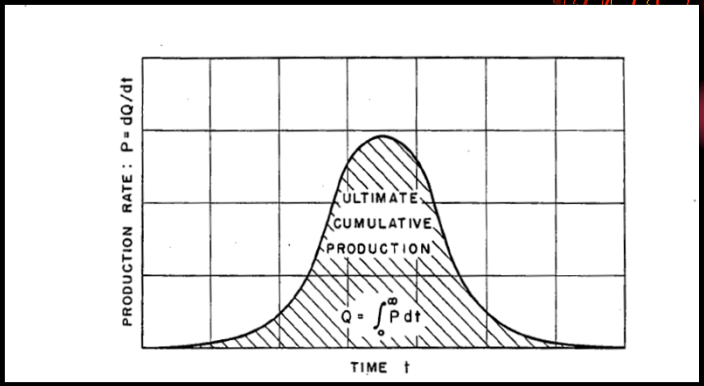

Figure 1: The Hubbert curve. (K. M Hubbert, 1956).

K. Hubbert designed the Peak Oil crisis curve in relation to the peak production of oil in the USA. He estimated it would be around 1970. This in fact was true.

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20th century: 'cheap oil'

Oil ($10-$20 per barrel) facilitated:

- widespread car ownership
- cheap personal mobility
- suburban and ex-urban housing
- decentralised activity sites
- globalisation of manufacturing & trade

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Oil demand & supply

Demand for oil increasing c1.5% p.a.

- +50% growth in demand in the last 25 years
- strong growth but low per capita consumption : China, India & some LDCs
- slow growth but high per capita consumption in MDCs
- world population increasing by 1.2% p.a.
- GDP per capita growing by c4% p.a.

Oil Supply & Demand 2008: 85 million barrels per day

Projected Oil Demand 2035: 120 million bpd

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Crude Oil Price

7 fold increase in 10 years:

- $12 per barrel 1999
- $86.79 on 2nd December 2010
- Fluctuations & price spikes: $100 January 2008 ; $146 July 2008

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Price

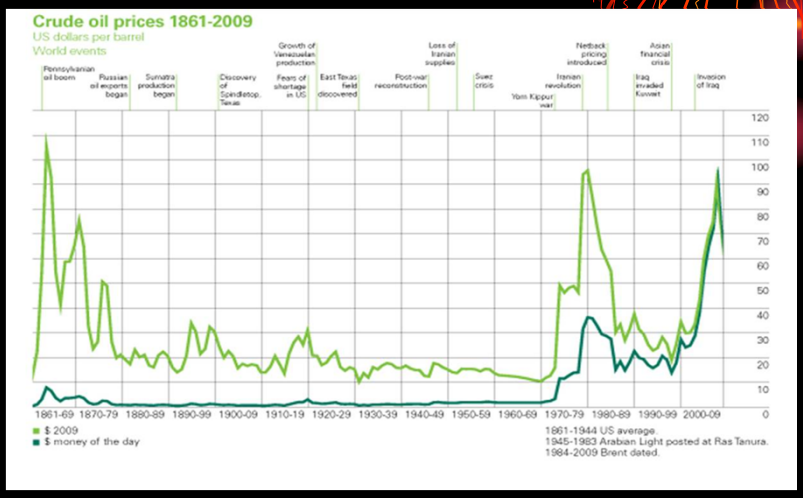

Figure 2: The crude oil prices 1861-2009. (BP, 2009).

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Peak Oil?

Oil discoveries : peaked globally in 1963: falling since

Oil reserves cover 40 years at current production

Local Peak Oil : 60 of 98 countries have passed peak

Global Peak Oil (excluding tar sands and biofuels):

- 2037 (oil industry) : transport still 92% dependent on oil in 2030?(EIA, 2008)
- before 2023 using Hubbert curve

(Tsoskounoglou et al, 2008)

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Alternative Fuels to 'dear oil' (Black, 2010; Kuby, 2010)

1. Methanol
2. Ethanol
3. Compressed Natural Gas (CNG)
4. Liquefied Petroleum Gas (LPG)
5. Biodiesel
6. Solar Power
7. Hydrogen

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Non-renewable Alternative Fuels

Four Alternative Fuels are non-renewable:

- Methanol from fossil fuels
- E85: ethanol 85% gasoline 15%
- CNG
- LPG

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Development problems with Alternative Fuels

- Cost
- Scale of Production
- Distribution & refuelling
- Adaptation of current vehicles
- Environmental effects
- Effect on food prices

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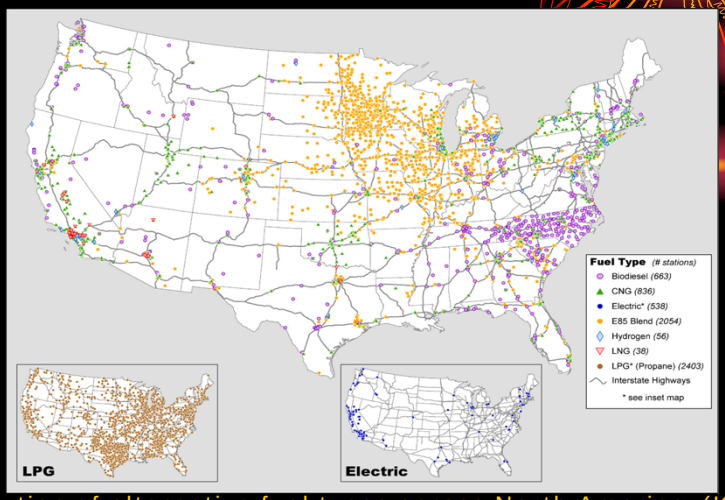

Distribution of alternative fuel types across North America. (Kuby, 2010).

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Possible effects of 'Peak Oil':

1. Dearer personal mobility

- Reduction in mobility: cost-space divergence
- Reduction in distance travelled (UK peak 2006)
- More 'mutual spatial proximity of destinations' (Dodson & Sipe, 2008)
- Reduced suburban & ex-urban development
- Revival of Transit-Oriented Development (TOD)
- Recentralisation of urban areas: CBD residential & employment growth
- Reduced growth in air transport traffic
- Increased investment in HST

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2. Economic impacts

Increased costs with 'Dear Oil' and Alternative Fuels

Effects on distribution costs: shipping, road haulage & air transport

Effects on national economies

Constraints on globalisation of manufacturing, trade & tourism

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Conclusion: Geography matters

- For over 200 years, time-space and cost-space collapsed differentially
- 'Collapses' have been due to innovations in transport and handling technology & 'Cheap Oil'
- Differential spatial effects are due to unequal investments

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Effects of 'Peak Oil', 'Dear Oil' & Alternative Fuels?

- More cost-space divergence
- Access to transport will continue to vary spatially and individually
- Increased importance of large demand centres & 'intermediate' locations
- Constraints on the growth of global manufacturing, trade and tourism
- Less developed countries become more peripheral

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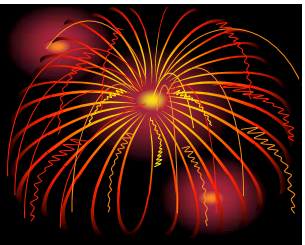

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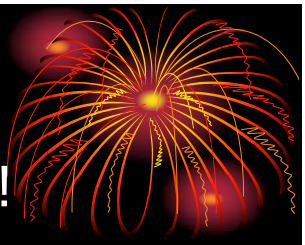

Thank You!

ANY QUESTIONS?