

## Preferred citation style for this presentation

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# Activity based modelling, accessibility and high rises

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Modulue VIII – Mobility and Transportation  
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**(FCL) FUTURE  
CITIES  
LABORATORY** 未来  
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实验室

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CENTRE** 新加坡-ETH  
研究中心

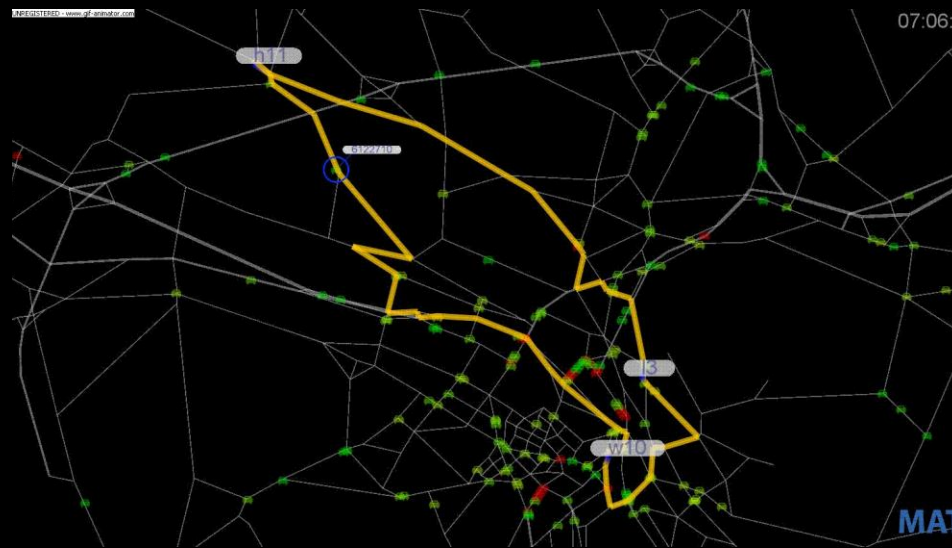
# Principles of agent-based transport modeling

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# Agent-based transport demand modeling and simulation with MATSIM

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</plan>
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# MATSim Singapore

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5 million agents



70'000 travel diaries  
7 days of EZ Link Data



80'000 home locations



79'635 links



10 desktops = 1 server



648 count stations



3.3 activities per agent



630'000 cars



2.3 million places of work



362 lines



1 day = 50 minutes

# A morning in Singapore with MATSim

fps: 5.8



<http://vimeo.com/55004446>

Vehicles: # 1601 / 670720

# What do we know about activities?

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## Travel diary

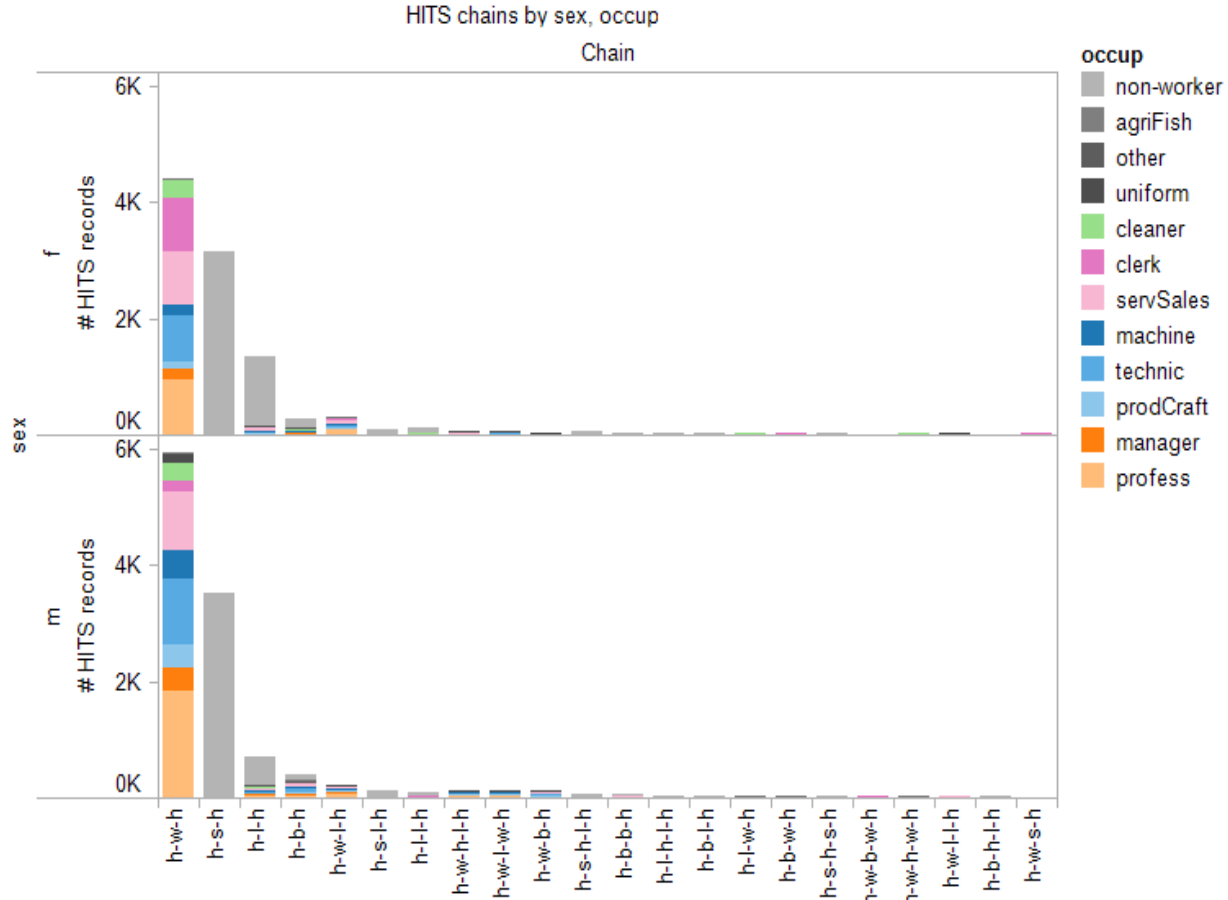
- Household interview travel survey (HITS)

- 1% of Singapore's resident population

- Only trips > 500m

- Underreporting of short activities, e.g. lunch, shopping

# What do we know about activities: example Singapore





# What do we know about activities?

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## Travel diary

Only trips > 500m

Underreporting of short activities, e.g. lunch, shopping

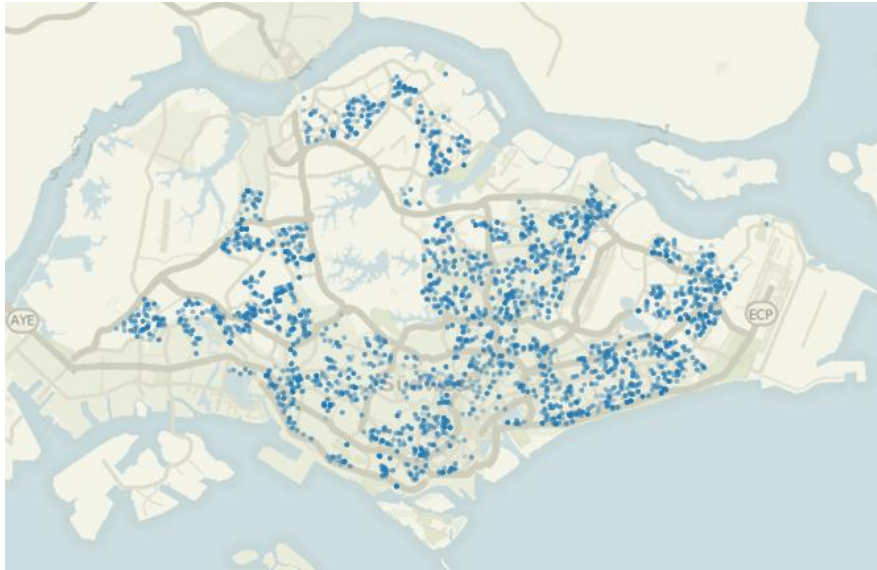
## Location of main activities

Home and work location from censuses

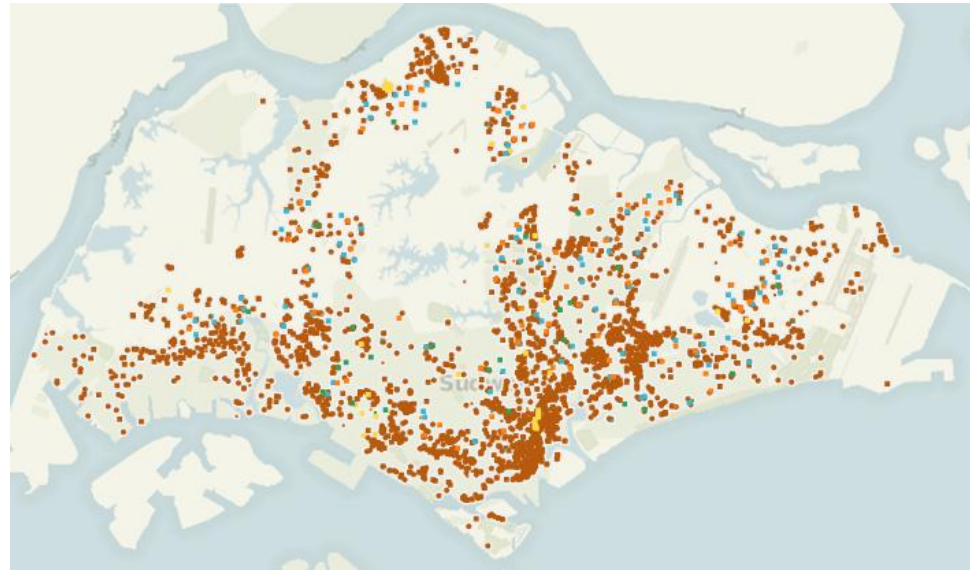
Connection between home and work location according to observed patterns

# What do we know about activities

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Home



Work, primary, secondary, tertiary, other

# What do we know about activities?

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## Travel diary

- Only trips > 500m

- Underreporting of short activities, e.g. lunch, shopping

## Location of main activities

- Home and work location from censuses

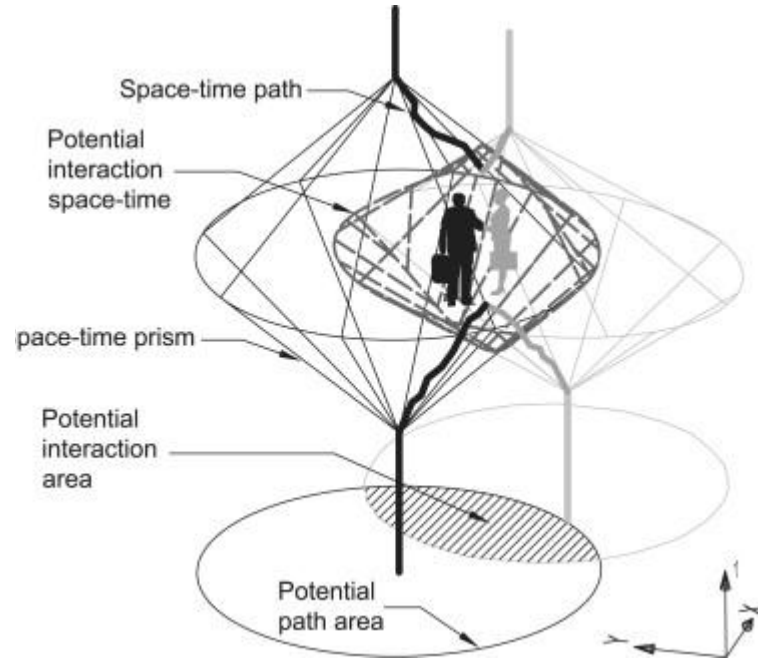
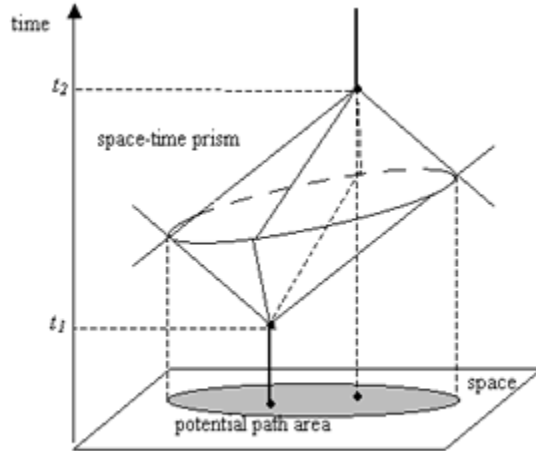
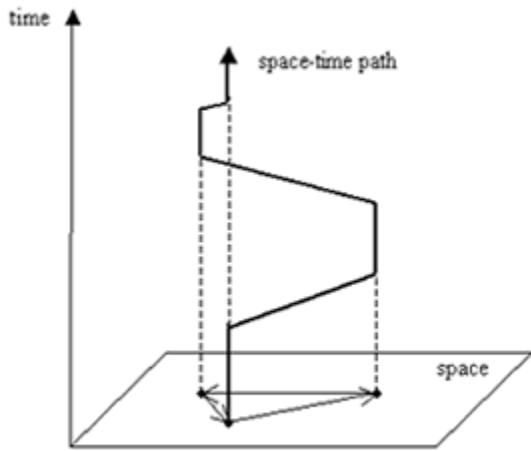
- Connection between home and work location according to observed patterns

## Location of secondary, 'in-between' activities

- Dependent on main activities

- Within time space prism

# What do we know about activities



# Change of scale: with MATSim

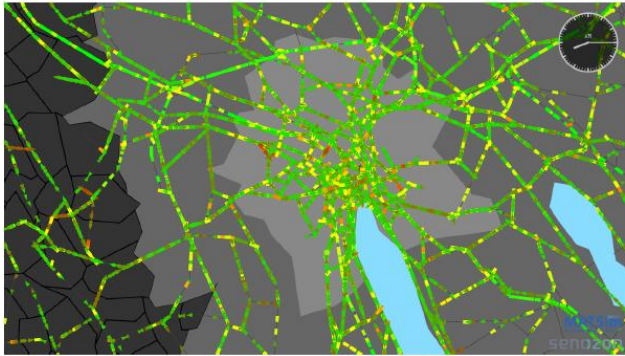


Fig. 9. City of Zurich with traffic flows at 08:15 a.m.

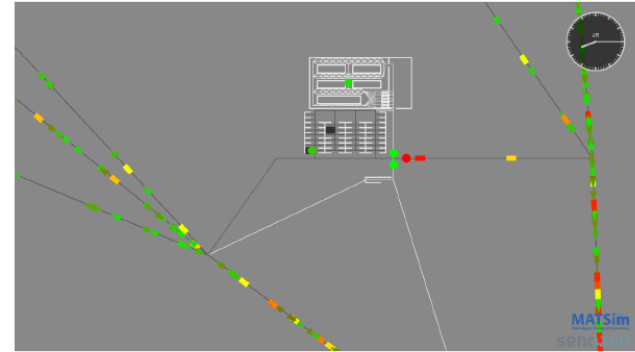


Fig. 10. Shopping center with traffic flows at 08:15 a.m.

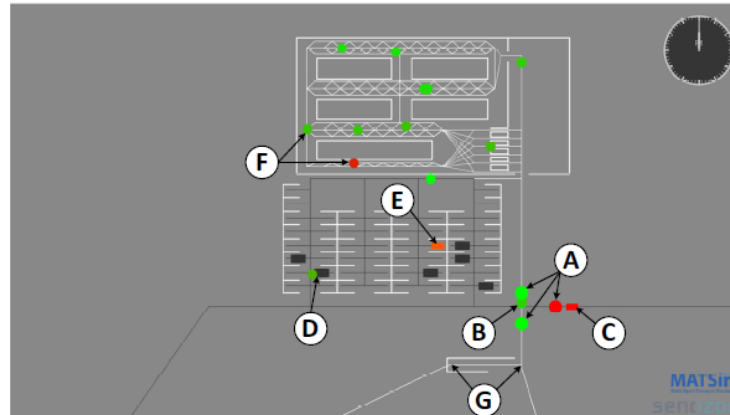


Fig. 11. Shopping center with traffic flows at 12:00 p.m.

Dobler, C. and G. Lämmel (2012) Integration of a multi-modal simulation module into a framework for large-scale transportation systems simulation, paper presented at the Pedestrian and Evacuation Dynamics 2012, Zurich, June 2012

# Measuring space and opportunities: accessibility

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Simplest form:

$$A_i = \sum_{j=1}^n d_{ij}$$

With distance threshold

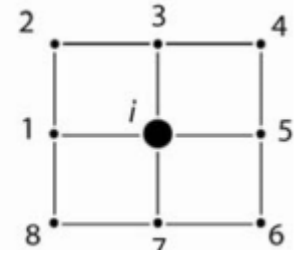
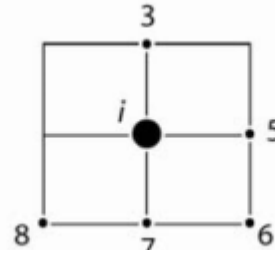
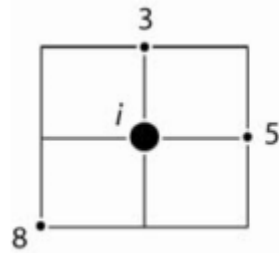
$$A_{id} = \sum_d O_d$$

As distance weighted sum

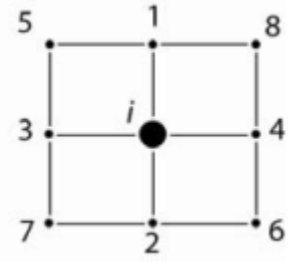
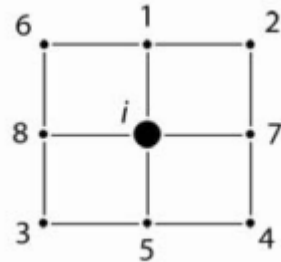
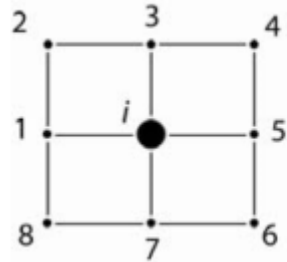
$$A_i = \sum_d \frac{O_j}{d_{ij}^\beta}$$

# Measuring space and opportunities: accessibility

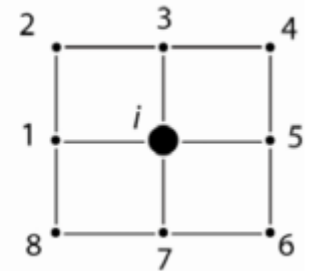
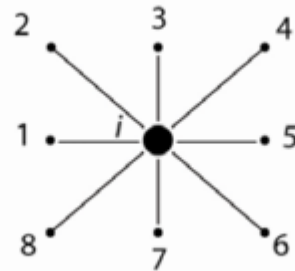
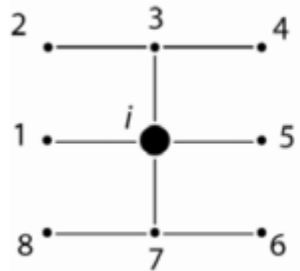
Change of number of opportunities



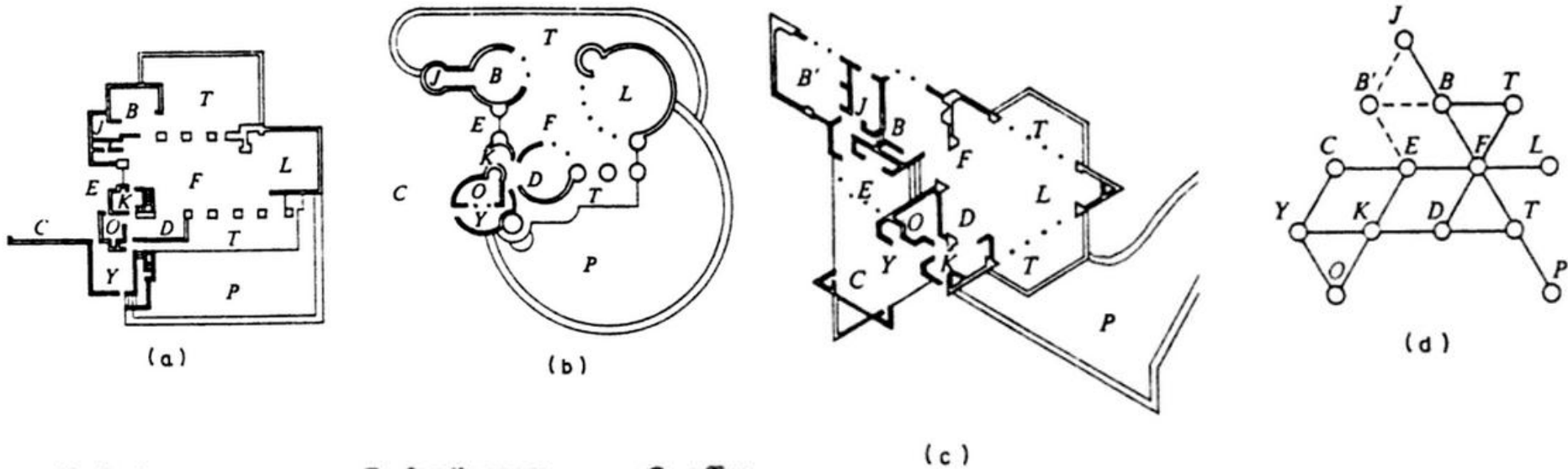
Change of layout



Change of spatial form



# Measuring space and opportunities: graph based approaches



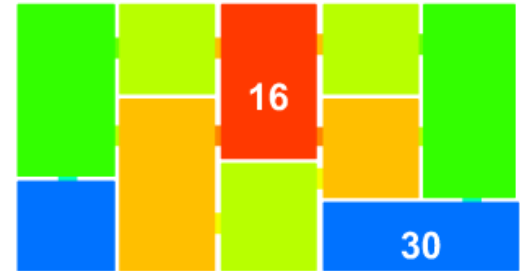
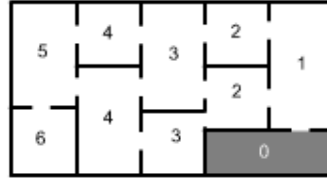
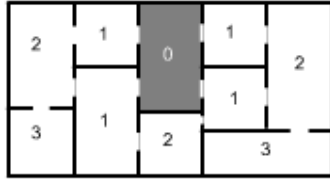
- |                         |                      |                  |
|-------------------------|----------------------|------------------|
| <b>B</b> bedroom        | <b>F</b> family room | <b>O</b> office  |
| <b>B'</b> Sundt bedroom | <b>J</b> bathroom    | <b>P</b> pool    |
| <b>C</b> car port       | <b>K</b> kitchen     | <b>T</b> terrace |
| <b>D</b> dining-room    | <b>L</b> living-room | <b>Y</b> yard    |
| <b>E</b> entrance       |                      |                  |

March, L. and Steadman, P. (1974) *The Geometry of Environment*, M.I.T. Press, Cambridge, pp. 24–25ff. (First published (1971) RIBA Publications Limited, London.)

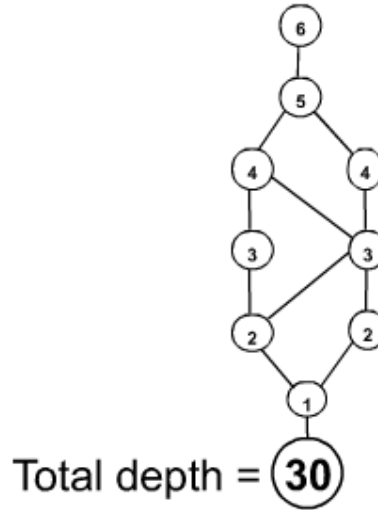
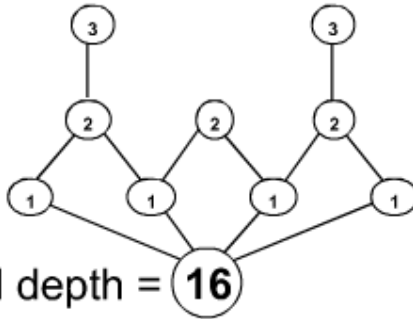
**Figure 4.51** Three houses by Wright: (a) Life house, 1938; (b) Ralph Jester house, 1938; (c) Vigo Sundt house, 1941; (d) access graph for the three projects. The dotted lines refer to the additional bedroom, B, in the Sundt house.



# Basic idea of Space Syntax



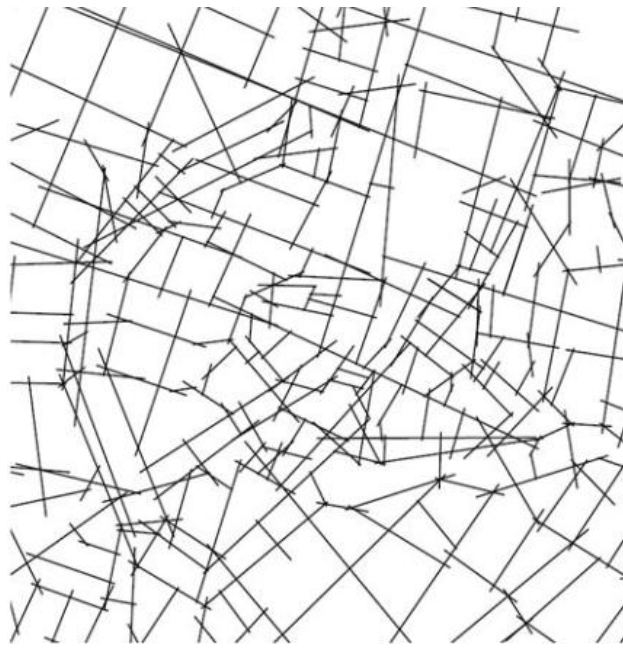
Using colours to represent numerical values provides an effective visualisation of simultaneous relations in spatial layouts.



Tim Stonor. (2011) What will the future city look like – The city of transaction, presentation held at IBM Smart Cities Seminar, Helsinki, Oct 2011, [http://cnode3.slideboom.com/presentations/431543/presentation.swf?slideboom\\_skin=0](http://cnode3.slideboom.com/presentations/431543/presentation.swf?slideboom_skin=0)

# Space Syntax applied to city street network

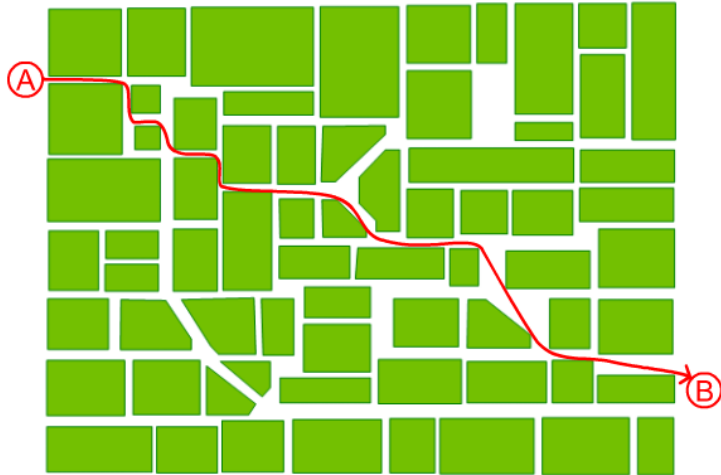
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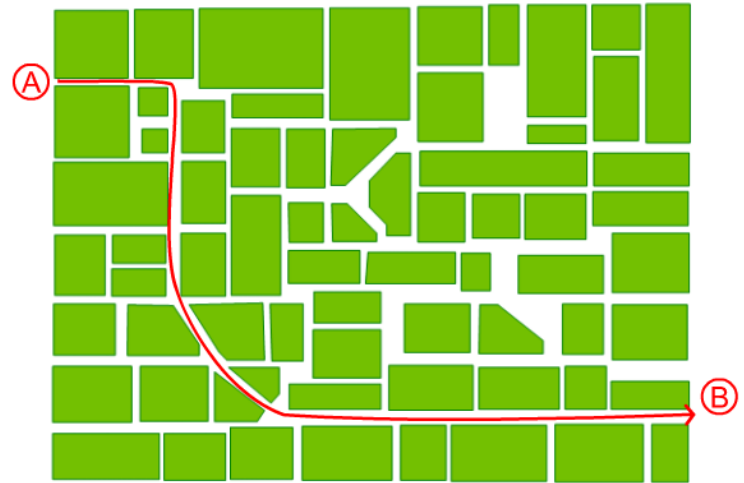
Tim Stonor. (2011) What will the future city look like – The city of transaction, presentation held at IBM Smart Cities Seminar, Helsinki, Oct 2011,  
[http://cnode3.slideboom.com/presentations/431543/presentation.swf?slideboom\\_skin=0](http://cnode3.slideboom.com/presentations/431543/presentation.swf?slideboom_skin=0)

# Basic idea of Space Syntax I: Angle turn count

Shortest path/least metric distance?



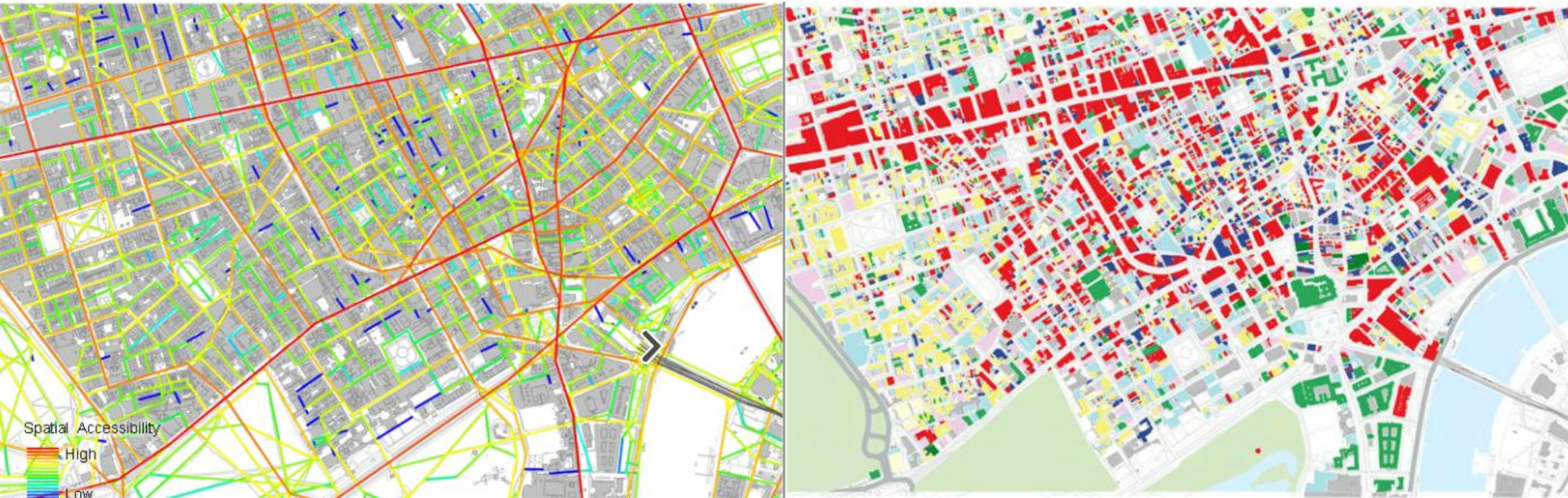
Simplest path/least angle change?





# Space Syntax: comparison with economic activity

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Tim Stonor. (2011) What will the future city look like – The city of transaction, presentation held at IBM Smart Cities Seminar, Helsinki, Oct 2011,  
[http://cnode3.slideboom.com/presentations/431543/presentation.swf?slideboom\\_skin=0](http://cnode3.slideboom.com/presentations/431543/presentation.swf?slideboom_skin=0)

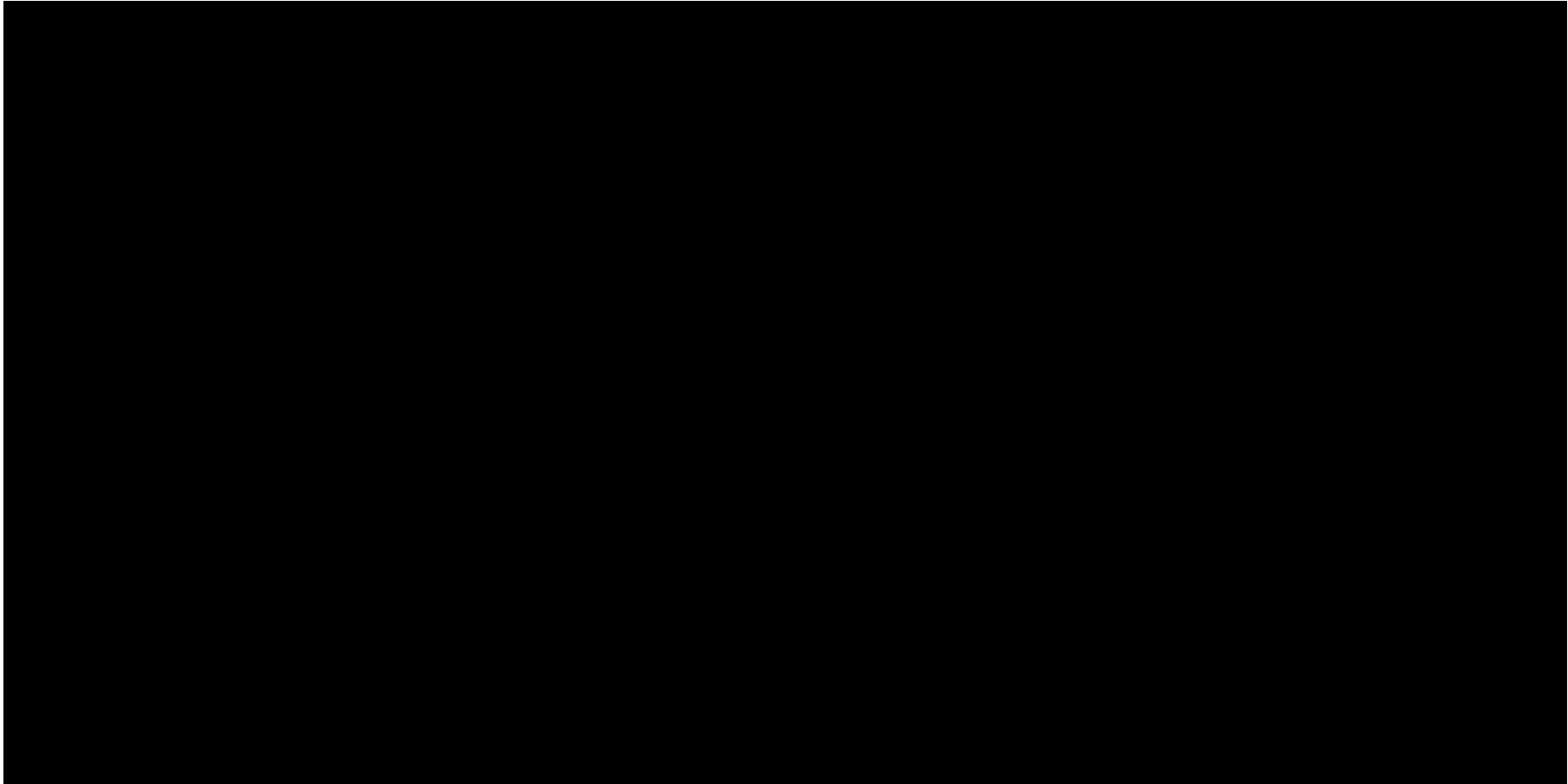
## Another measure, similar result: betweenness

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# Space syntax and agent-based modelling

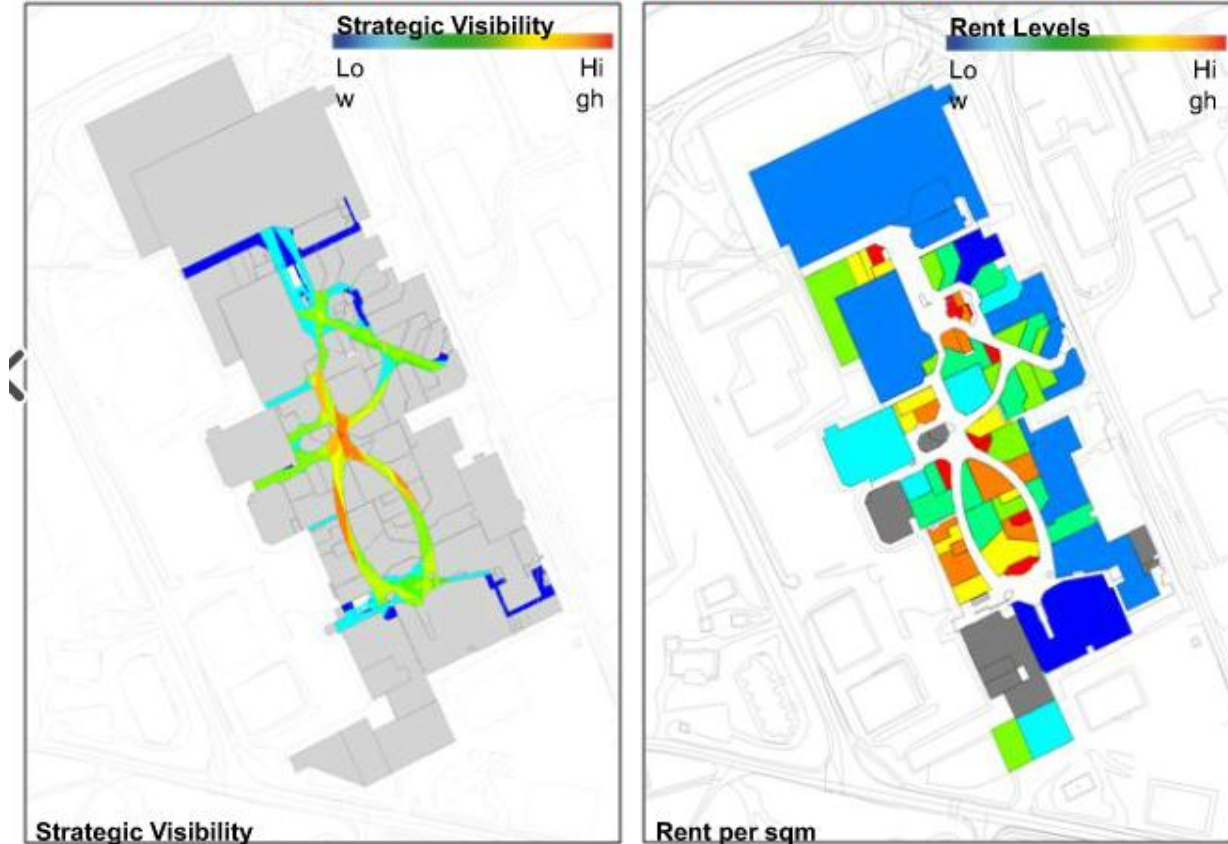
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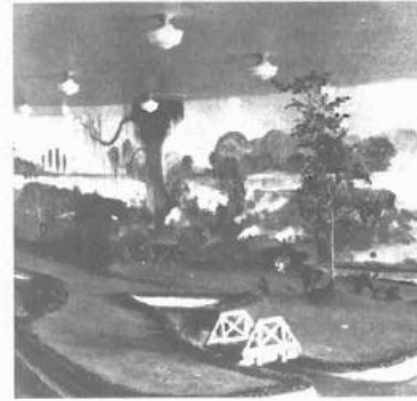
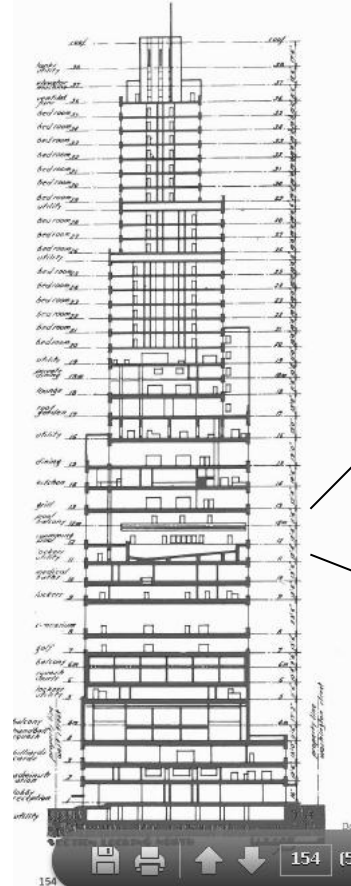
# Visibility and location choice within a shopping centre

## Retail **Shopping mall, Scandinavia** Strategic layout assessment

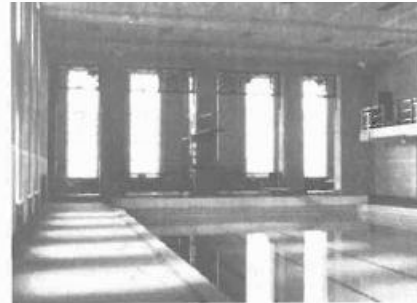


Tim Stonor. (2011) What will the future city look like – The city of transaction, presentation held at IBM Smart Cities Seminar, Helsinki, Oct 2011.

# Different activities in a highrise: downtown athletic club



Downtown Athletic Club, seventh floor; interior golf course.

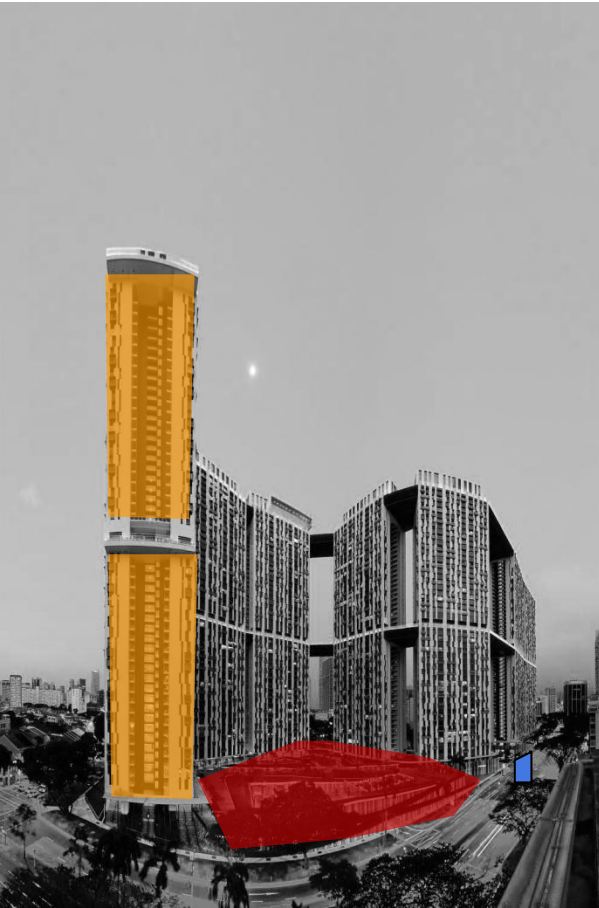


Downtown Athletic Club, 12th floor; swimming pool at night.

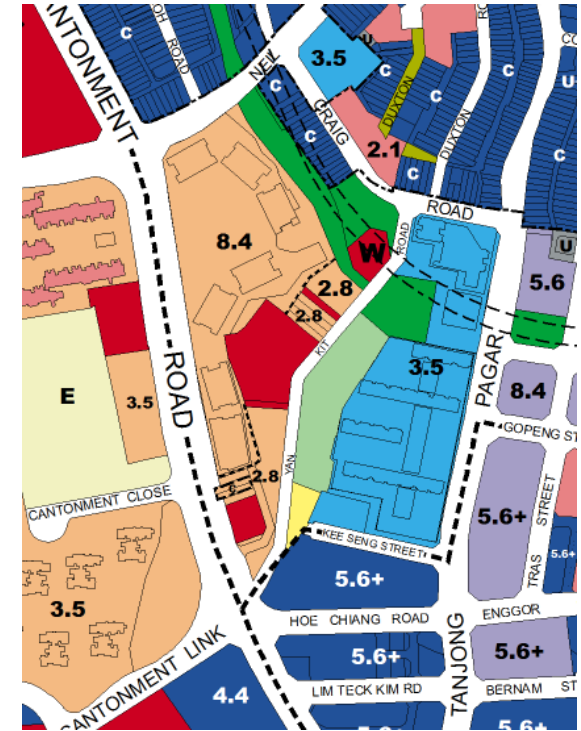
Rem Koolhaas (1994) "Delirious New York: a retroactive manifesto for Manhattan", reprint, The Monacelli Press.



# Mainly monofunctional activities in a highrise: Pinnacle @Duxtion



- RESIDENTIAL
- RESIDENTIAL WITH COMMERCIAL AT 1ST STOREY
- COMMERCIAL & RESIDENTIAL
- COMMERCIAL
- HOTEL
- WHITE
- BUSINESS 1
- CIVIC & COMMUNITY INSTITUTION



# Wrapp up: type of activity and patronage

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## Mandatory activities

- Frame our daily lives

- Repetitive activities

- Different patronage densities for home/work/education

## Planned secondary activities

- Having lunch, daily shopping and leisure activities

- Conscious decision making

- Bring people together

## Induced secondary activities

- Performed because of convenient opportunity, e.g. beer at the pub, lunch in the park

- Subconscious decision making

- High activity density -> make a lively environment

- Bring even more people together