Finding the Right Level of Abstraction

Make your models fit for their purpose

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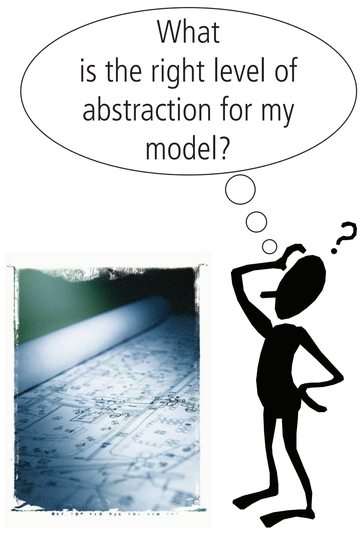
Problem

A model is an abstract representation of an original for a given purpose (typically some analysis).

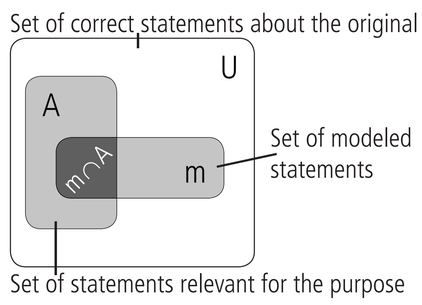
However, a model at the wrong level of abstraction looses much of its value!

» Model too abstract
  » Model may lack some important details
  » Imprecise or incorrect conclusions about the original
» Model too detailed
  » Model larger / more complex than necessary
  » Waste of time for modeling irrelevant details

Need for objective evaluation and systematic improvement of models' level of abstraction



Proposed Solution



$$\text{precision}(m,A) = \frac{|m \cap A|}{|m|}$$

$$\text{recall}(m,A) = \frac{|m \cap A|}{|A|}$$

Idea: measure the deviation of the set **m** from the set **A** with:

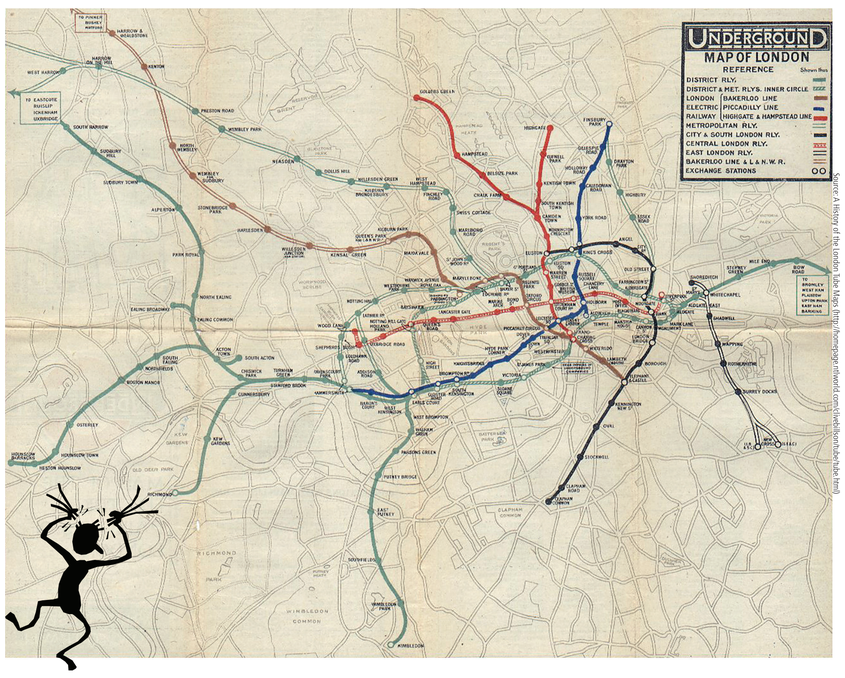
» **Precision**
  Proportion of modeled statements that are indeed relevant
» **Recall**
  Proportion of relevant statements that have actually been modeled

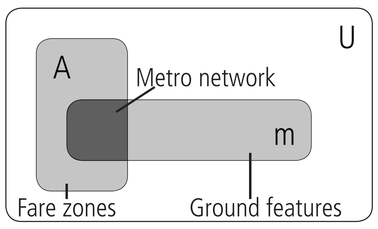
Problem: the set A can hardly be defined

» Establish usage profiles for every major category of modeling purposes
» Measure abstraction against these usage profiles

Illustration: London Tube Maps

1919

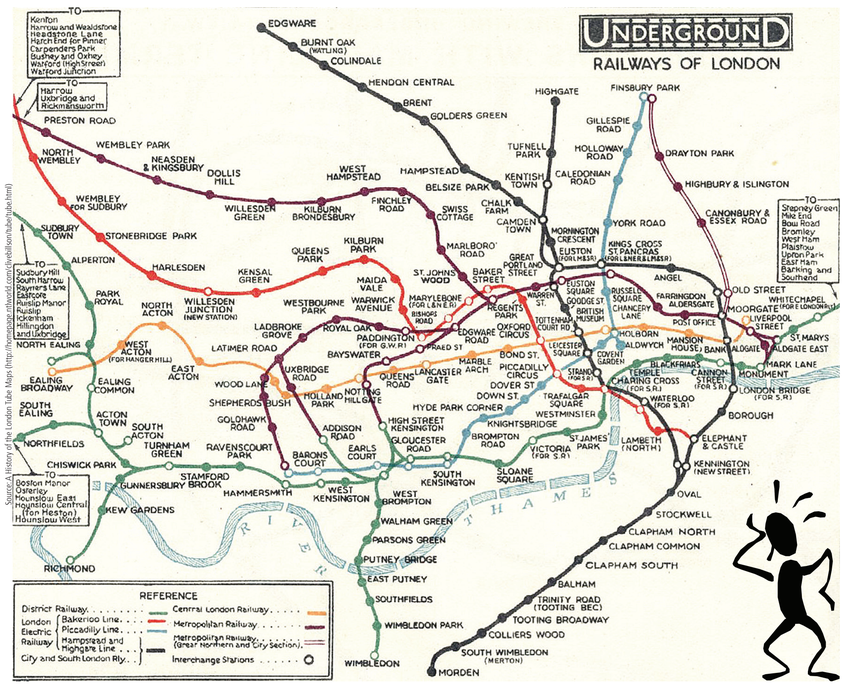




» Geographic map
» Physical location of stations
» Exact geometry of lines

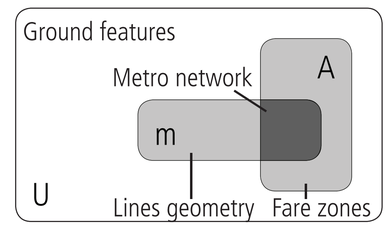
✖ Poor precision
~ Sufficient recall (for navigation)

1928

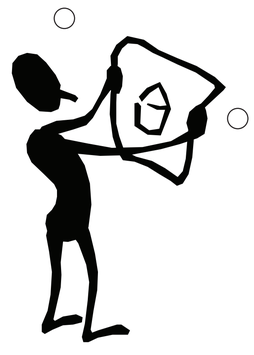


» Suppression of ground features
» Distortion of outlying lines

↗ Improved precision
~ Same recall



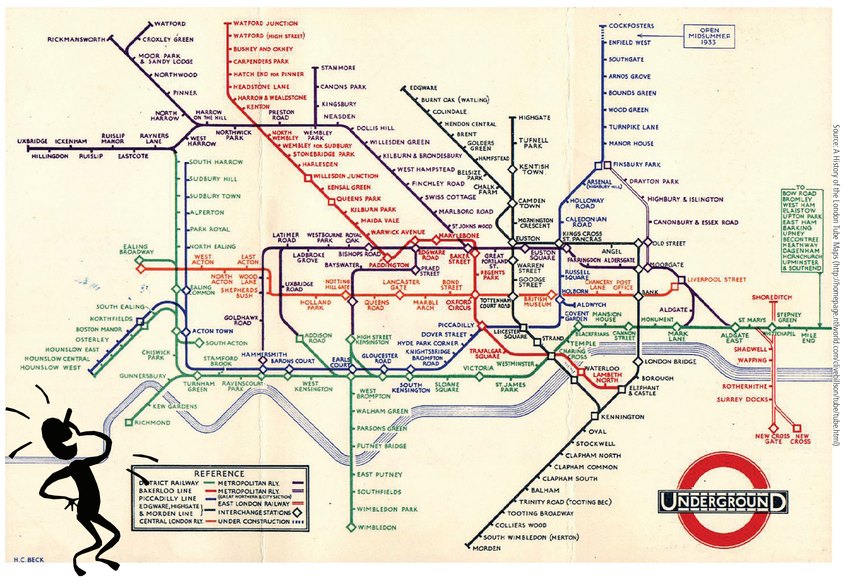
How
do I go to
Wimbledon from
East Ham?

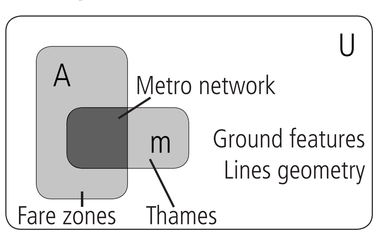


How
much does
it cost?

How
long does it
take?

1932

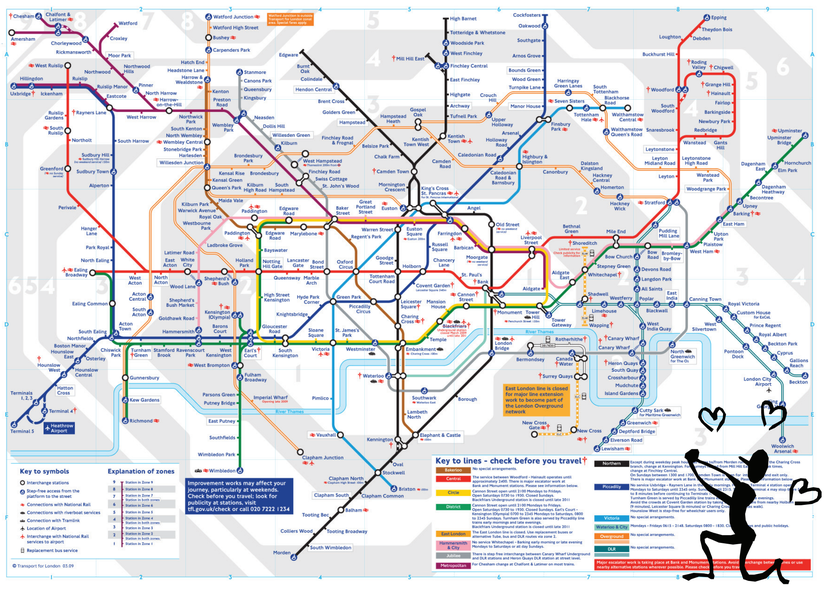


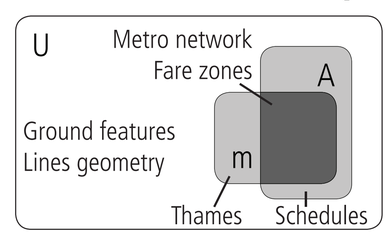


» First schematic representation
» Topology of the network only

↗ Improved precision
~ Same recall

2009





» Fare zones
» Connection to other transports
» Accessibility of stations

~ Same precision
↗ Improved recall (cost estimation)

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