Metro Maps

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- Some pictures and a commentary

- This is not research, it is just a collection of observations.
The pipeline view of the visualization process

This talk concerns the last step of the pipeline.
The Diagram of the London underground: history

- 1900: First maps of the London Underground are issued.
The Diagram of the London underground: history

1900 1920 1940 1960 1980 2000

1931
• Harry Beck produces *The Diagram*, the first schematic map.
• It is rejected by management.
The Diagram of the London underground: history

1900 1920 1940 1960 1980 2000

1933
- Management accepts and publishes the diagram.
- It quickly becomes adopted by all users of the underground.
The Diagram of the London underground: history

1900  1920  1940  1960  1980  2000

1933 - 1999+
- Many changes to the diagram
  - improvements in graphic design
  - changes to the underground force changes to the diagram
London metro maps before Beck:

- Strongly geographically based.
- Geographical background is displayed in a colour that is close to the background colour.
The details of the graphic design in the early maps were excellent.
In 1931, Harry Beck made a radically different sketch of the underground.
Beck’s “diagram” was polished and then sent to his manager.
However, it was rejected, perhaps because it was not geographically based.
Beck was persistent and his diagram was eventually printed in 1933.

- 750,000 “cards” in January.
- 100,000 in February.
- A poster version in March.
By the 1970s the diagram had become a work of art.
A graph drawing is a display of nodes and links between nodes.

The main problem in creating a graph drawing is to decide

- where the nodes are located
- where the links are routed.
Graph drawings
Graph drawings
Graph drawings
The Diagram exhibits many elementary principles of graphic design

- Unnecessary information has been deleted; it displays only links between stations.
- Train lines are cleverly colour coded.
- Many items (eg, interchange stations) are cleverly symbol-coded.
The Diagram is also a very good graph drawing

- Stations are separated by a reasonable distance from other stations and train lines, so that the names of stations can be displayed in a large font.
- Train lines are separated by a reasonable distance.
The Diagram is a very good graph drawing

Train lines
- fairly straight.
- few angles are used.
- most lines are either horizontal, vertical, or at 45 degrees.
The lessons for good graph drawing

- Try to ensure good resolution
- Use straight links
- Use few angles
- Use horizontal, vertical, 45 degrees lines.
The diagram not geographically accurate, but it retains some of the properties of the geography of London.
Geography and The Diagram

**Orthogonal ordering**
- Left is left and right is right
- Above is above and below is below.
Geography and The Diagram

**Topology**
- What is inside is inside
- What is outside is outside
Geography and The Diagram

*Proximity*

- What is close is close
- What is far is far
The mental map

The Diagram should not destroy the user’s *mental map* of London.

The

- orthogonal ordering
- topology
- proximity

should be preserved.

In The Diagram, this is achieved by cleverly *distorting* geography.
A visualization which changes over time should not destroy the user’s *mental map*.

The

- orthogonal ordering
- topology
- proximity

should be preserved.
Washington