



Cartography Lecture #8 DYNAMIC REPRESENTATION: FLOW MAP

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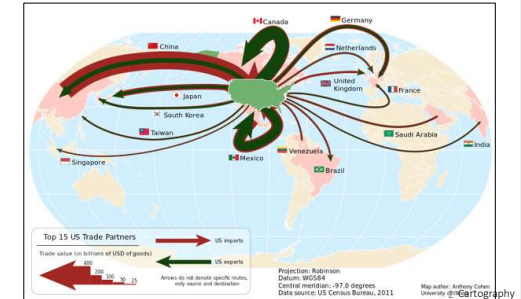
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DYNAMIC REPRESENTATION: FLOW MAPS

Flow maps are a type of thematic map used in cartography to show the movement of objects between different areas.

Applications of flow maps:

1. Can show the movement of goods across space,
2. The number of animal species in a specific migration pattern,
3. Traffic volume and stream flow.
4. Show both qualitative and quantitative data.



Characteristics that influence the flow map

1. **Intelligent Distortion:** Some flow maps feature distortion to show the movement of goods. Therefore any intended distortion mustn't change the meaning of the map.
2. **Merging of Edges that Share Destinations:** If many lines are going to the same destination it is important that their edges be combined to reduce map clutter.
3. **Intelligent Edge Routing:** In some cases, branches or lines on flow maps will route themselves through the centre of the map. This can obscure the other lines so they can be routed to the edge of the map so that all of the data can be easily seen.
4. **Layering and Branching Structure:** Some flow maps have a common set of nodes. In these cases, layering of their lines works well to reduce map clutter.
5. **Linear or Logarithmic Display Widths:** Flow maps can use both linear and logarithmic display widths. It is important to choose the correct one to best show the data.

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DESIGNING FLOW MAPS

Creating effective flow maps through a careful and thoughtful design plan represents one of the more difficult challenges for the map designer because many GIS and mapping software do not have a dedicated "flow map" procedure.

Regardless of the production method, three aspects of the design must be considered:

1. Map organization and figure ground (including the selection of the projection),
2. Line symbolization and data scaling, and
3. Legend design.

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Quantitative Flow Maps

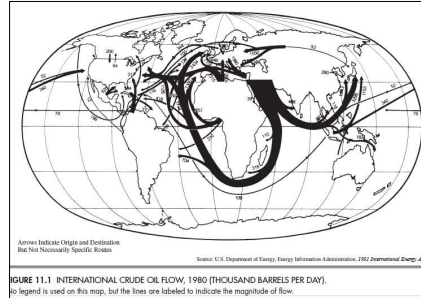
In quantitative flow maps, the line's width or hue parameters indicate the magnitude of the flow. In the former and more common case, thicker lines indicate greater flow magnitudes.

1-Data Suitability

A flow map is a flexible form for a variety of different attribute data. In the case of scaling line widths, the data requirements are like those of proportional symbol maps.

2-Directed and Undirected Flows

Flow maps may or may not use arrows in their design. Flow maps with arrows are sometimes called **directed flow maps** because the flow is travelling along the line only in the direction of the arrowhead. **Undirected flow maps**, in most printed and virtual static maps, flow maps without arrows imply movement in both directions. These types of flow maps are sometimes referred to as **undirected flow maps**.

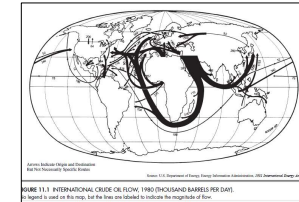


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UNDIRECTED FLOW MAP

This form of data generalization perhaps shows less information than directed flow maps, but undirected **flow maps are used, for one of three reasons**:

1. Much of the current vehicular traffic data is already aggregated for both directions.
2. It is often impractical to portray both directions on many flow maps (such as a flow map depicting highway traffic at a small or medium scale). Again, flow maps can get very complex.
3. It is easier to generate undirected flows in most GIS and mapping software.

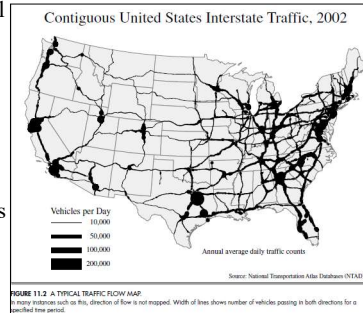


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The Relevance of Flow Routes

Flow maps may or may not attempt to follow the actual routes of movement. In the case of many **traffic flow maps**, the actual routes (or some close approximation) show the organizational and hierarchical nature of the state or urban road systems.

For example, varying line widths can be used to symbolize the number of vehicles passing over portions of a state's major highways



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Essential Design Strategies

A summary of the essential design strategies for flow maps should include these principles

1. Flow lines are the highest priority in visual/graphic importance.
2. Smaller flow lines should appear on top of larger flow lines *if* they must cross or overlap.
3. Arrows are necessary if the direction of flow is critical to map meaning.
4. If the data permit the map designer to control line placement, lines should be placed in a manner that balances the entire map (that is, not too top-heavy, bottom-heavy, and so on).
5. Land and water contrasts are essential (if the mapped area contains both).
6. Projection, its centre and aspect, are used to direct readers' attention to the flow pattern important to the map's purpose.
7. All information should be kept simple, including flow line scaling.
8. Legends should be clear and unambiguous and include units where necessary.

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Flow map Design criteria

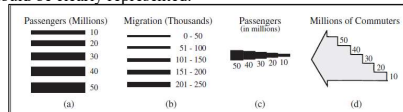
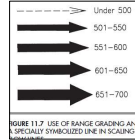
Line Scaling and Symbolization

On most quantitative flow maps, the widths of the flow lines are proportionally scaled to the quantities they represent.

Legend Design

The legend is the crucial link in cartographic communication between the cartographer and the map reader, as it serves to explain carefully the symbols on the map. The legend must above all be clear and unambiguous.

Units of measurements must be prominently displayed and it must be obvious how the lines are scaled, and the flow lines in the legend must appear exactly as they are on the map. If the data have been classed, the class boundaries should be clearly represented.



A variety of design options exist for flow maps when the lines' widths have been scaled. These include specified key values (a), range graded (b), telescoping (c), and separate designs (d). In directed flow maps, arrows are sometimes placed on the lines in the legend. See text for discussion of color-based flow maps.

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Map Organization and Figure-Ground

The map's hierarchical plan must be carefully considered. The flow lines are almost always going to be the most dominant features on the map.

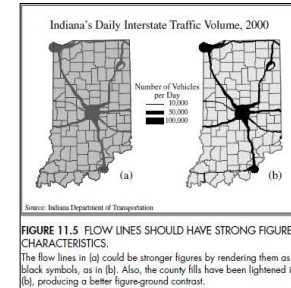
lines may first be over land, then water, land again, and so on.

They may also intersect other flow lines, potentially confusing the map reader. As with other thematic symbol types, flow lines should have strong edge gradients and be rendered so that visual conflict with other symbols does not result

Ref:

Chapter 11 of book TECHNIQUES OF QUANTITATIVE THEMATIC MAPPING

Ref: <https://www.gislounge.com/overview-flow-mapping/>



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Thank you