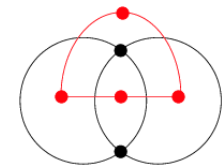


1.5 Combining layout and integrating labels

Here we look at some issues in the practical application of automated layout

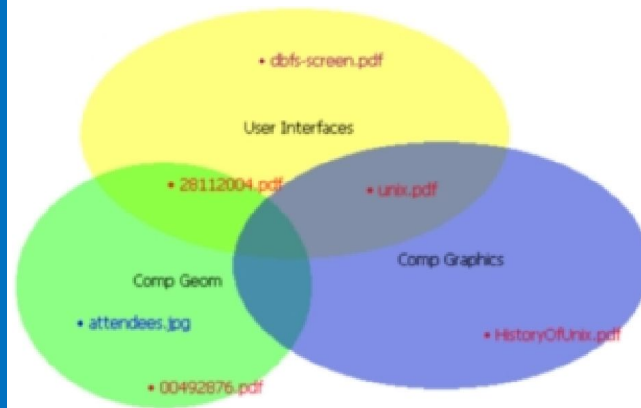
Firstly, pure Euler diagrams or graphs are rarely applied in the real world, most applications have extra visual information. Here we look at cases where Euler diagrams and graphs are combined

Secondly, labelling is a significant feature of most useful diagrams, and we outline various labelling techniques

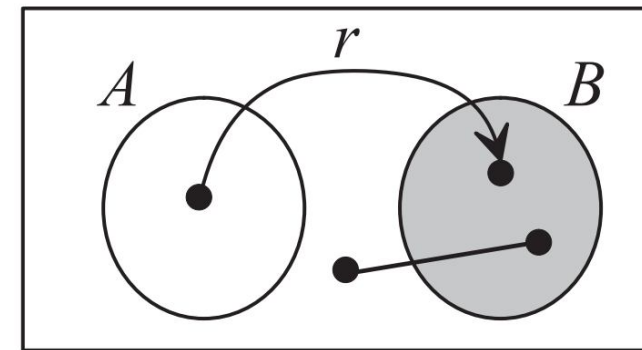


Layout combining diagram types

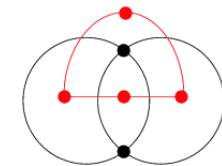
Euler diagrams are frequently used in application areas where items are placed in association with the zones



VennFS



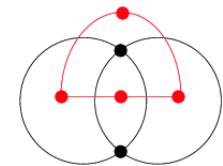
Constraint Diagrams



Individual items in zones

Here, typically, the requirement is that the Euler diagram is laid out, then the items placed in the relevant zones

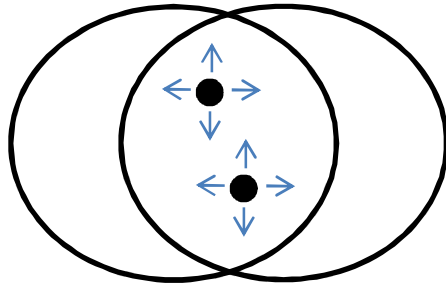
Although when the numbers of items in zones varies greatly, area-proportional zone layout might be useful



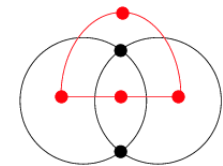
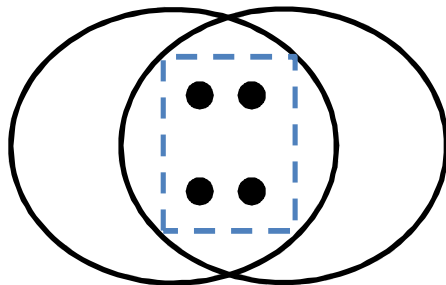
Placing items in zones

Techniques include

Simple force approach, repulsion of items from each other and the zone borders



Even placement in a maximal rectangle in the zone



Integrating graphs

The approach will depend on the application

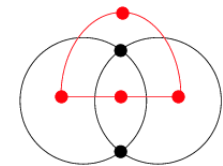
What is most important?

- Euler diagram layout

- Graph layout

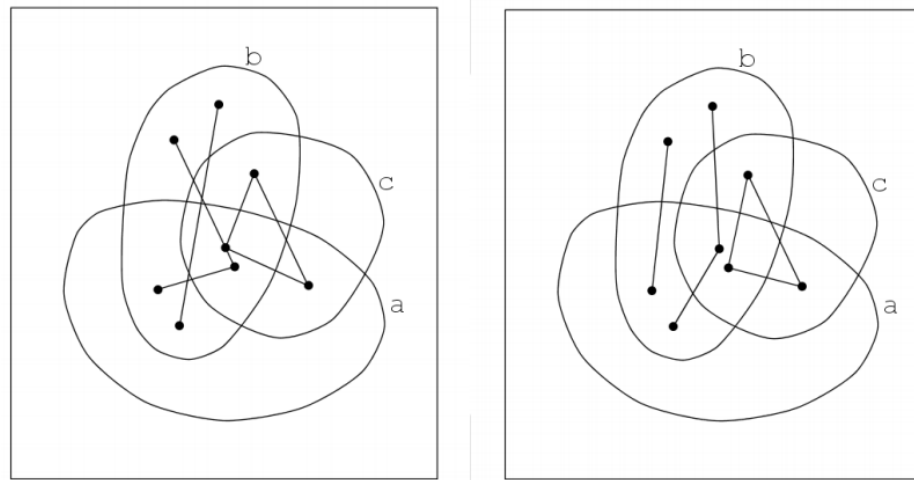
- Combination of both

Various strategies exist

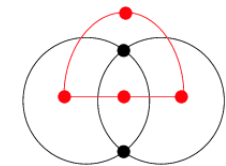


Emphasizing Euler diagram layout

Methods similar to those placing individual items can be employed. E.g. Force directed:

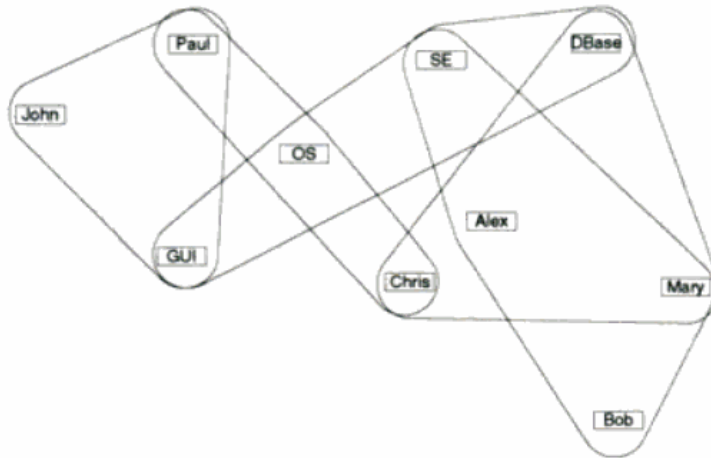


Here, we have placed the vertices with a force model. On the right is the subsequent application of a search to assign edges to items in zones

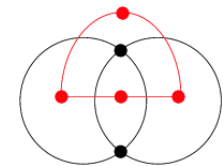


Emphasizing graph layout

It is possible to get a layout using a convex hull of the required vertices. Extra zones created might be shaded, and disconnected curves reconnected using non-simple curves



A hypergraph drawn using convex hulls



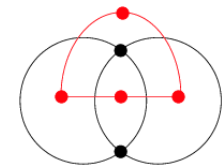
Combined Layout

Considerably more problematic

Force models are unlikely to be successful, due to requiring several competing forces. Force models for Euler diagrams are complex, further force additions are likely to fail

Multicriteria optimization might be successful. However the number of criteria is likely to be large, and so the system will run very slowly, again there may be a problem with the large number of required criteria

This is an open problem

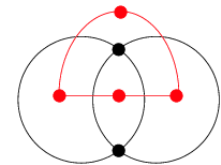


Labelling

Unambiguous, clear labelling is fundamental to producing comprehensible diagrams.

The majority of research in labelling comes from the world of cartography

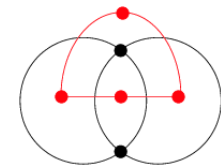
However, this work cannot always be used without alteration in diagram drawing, because of the potential to change the diagram layout to improve the labelling



Task

Example

Rearrange this section of the London Underground map so that the label for "Holborn" is no longer ambiguous



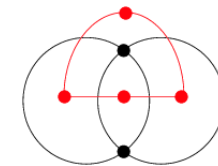
Cartographic concepts

In Cartography labels are required for

1. Area features
2. Line features
3. Point features

These correspond to

1. Zone labels
2. Edge and curve labels
3. Vertex labels



Labelling methods

Rule based methods

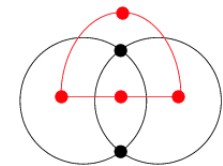
Here a set of rules, derived from studies of human cartographic label placement, are used. The labels are typically given priority, with high importance labels placed first

Greedy Algorithms and Search

Overlap and ambiguous locations can be measured, and so in a greedy algorithm, the labels can be placed on at a time, with each in the optimum location for the current layout. However, more sophisticated search can be used to prevent poor placement of the latter labels

Force Directed

Particularly for point labelling. Labels can be allowed to rotate around the point, with a repulsive force acting between labels

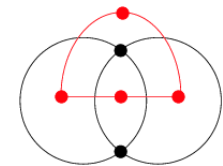


Integrating Labelling and Diagram Layout

It is possible to integrate labelling into both force directed and multicriteria diagram layout methods

Label layout criteria and label movement have been added to multicriteria graph layout systems

It is feasible to add a single point label layout force (perhaps also a linear edge label force) to a force directed graph drawing algorithm



Summary

Practical use of automated layout requires dealing with all the visual components of a diagram
Here we have discussed integrating graph and Euler diagram layout methods

Labelling is also a key aspect of any practical layout system, one that is often ignored by layout researchers

