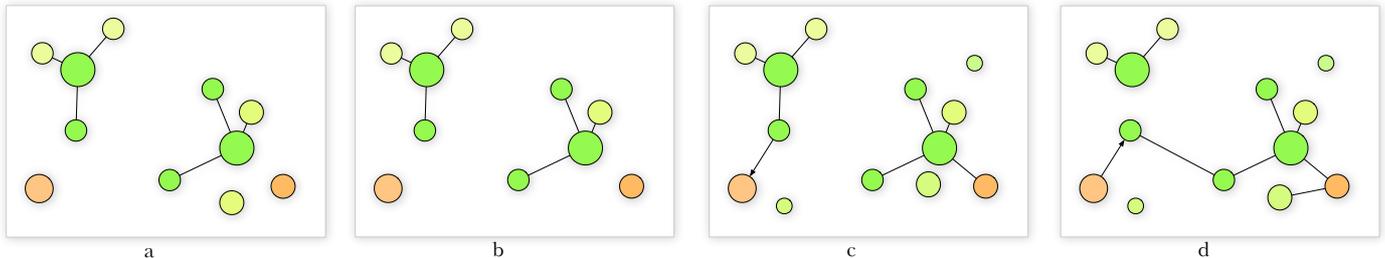# Time Sequences

Visualisations of dynamic data using non-linear timelines

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Spot the difference!

| a | b | c | d |

Dynamic visualisations of graph structures undergo changes as the visualisation progresses.

- nodes are added or removed
- edges are added or removed
- The "weight" of either nodes or edges can change
- The clustering of nodes can change

These changes disrupt the user's *mental model*.

When the mental model is disrupted, users may miss new incoming changes, or fail to understand the significance of changes, as they must keep up with the rate that the visualisation is changing.

Changes occur at different rates and at irregular intervals, making the visualisation more difficult to follow. There may be long gaps of inactivity, while other changes all occur together.
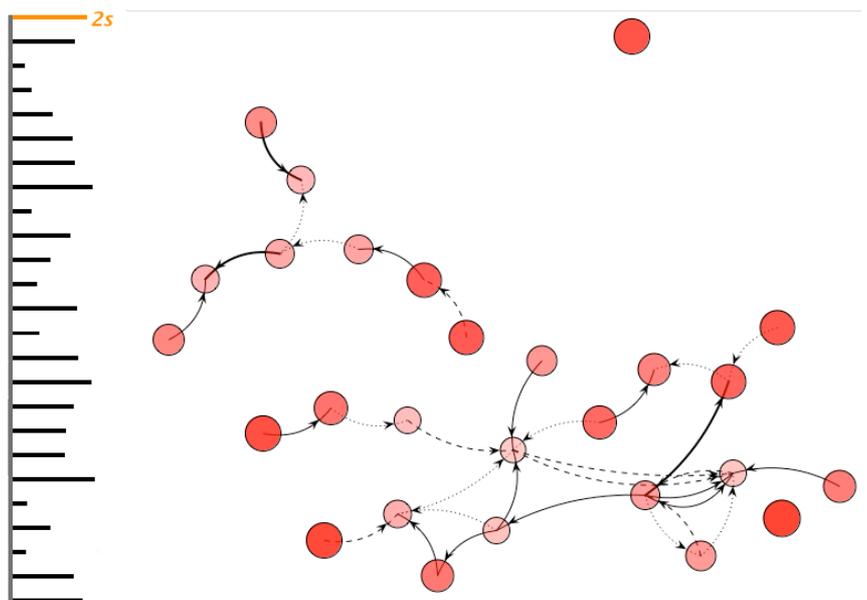
Time Sequence Visualisations

Our Time Sequence Visualisation technique **manipulates the flow of time** to make dynamic graph **updates occur at regular intervals**. An update to the graph occurs every two seconds, regardless of how long passed in real-time since the last update. This update time can be modified depending on the density of activity within the timeline.

We pair the traditional node-link graph visualisation with a **visual timeline** (right), which scrolls down the screen as new updates occur to the graph. The length of each notch on the timeline indicates the amount of actual time that passed.

Long gaps of inactivity are compressed into a regular duration, while dense areas of high activity are expanded so that the viewer has additional time to understand the significance of these events.

The timeline acts as a **visual history** of the activity in the graph. As the human eye is better at judging relative lengths than the brain is at estimating time, this technique has the potential to improve a user's understanding of the data.

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