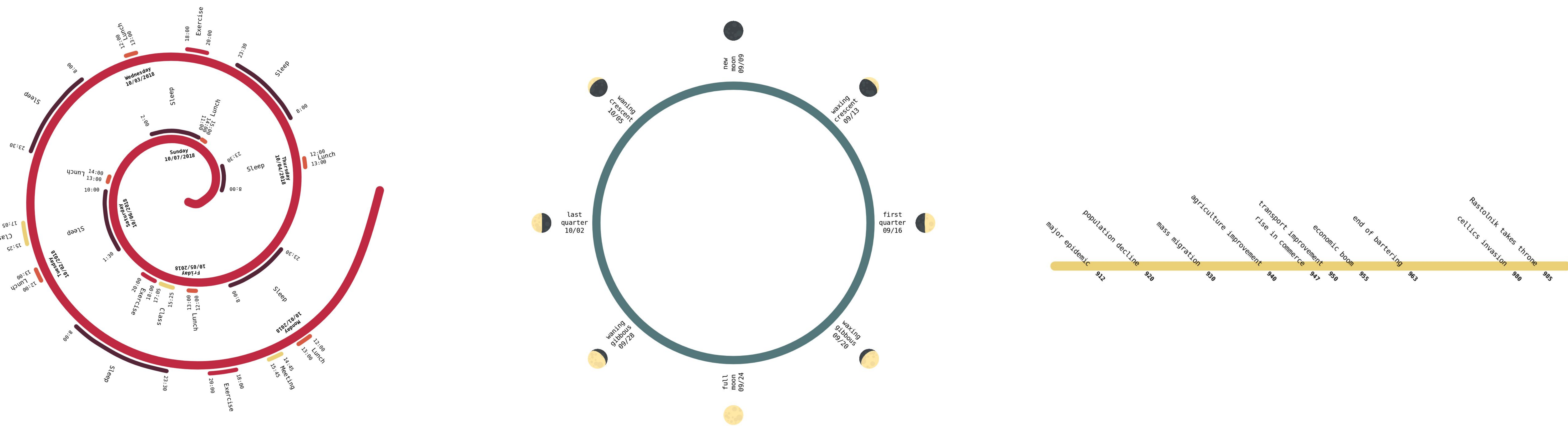# Shapeshifting Timelines
An evaluation study on recurrent versus non-recurrent data

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Introduction

We evaluated 3 timeline representations for their respective effectiveness on different types of datasets.

Our hypotheses were:
- A **Linear timeline** is more suitable to represent **non-recurrent event data.**
- A **Circular timeline** is more suitable for **recurrent event data.**
- A **Spiral timeline** is more suitable for **serial-periodic event data.**

Examples of data types used

serial (non-recurrent)	a fictitious world history
periodic (recurrent)	moon phases
combined serial-periodic (a combination of recurrent and non-recurrent)	weekly schedule of a person

Although linear timelines are the most common type and every user can immediately feel comfortable with a linear timeline, we show that this does not always mean that a linear timeline will significantly perform better than other shapes. Our results show that **in certain tasks a different representation may be more appropriate** or at the very least won't significantly impair user readability.

Methodology

We developed the visualizations using paper.js. We **made a visualization for each shape using each one of the 4 dataset**, resulting in 12 visualizations in total.

We then performed the experiment on three groups of subjects: Using the 4 datasets, subjects were asked a series of questions pertaining to the information presented in the timeline.

During the experiment, we **tracked their gaze with an eye-tracking device** to understand **where they focused their attention**, and **how their eyes explored the data along the different shapes**.

Their responses were recorded for time and accuracy. Preliminary results showed fastest average response times for linear layouts, but also highlighted some unexpected phenomena, like how well spirals worked for a combination of recurrent and non-recurrent data.

### Fixation points for the moon dataset:
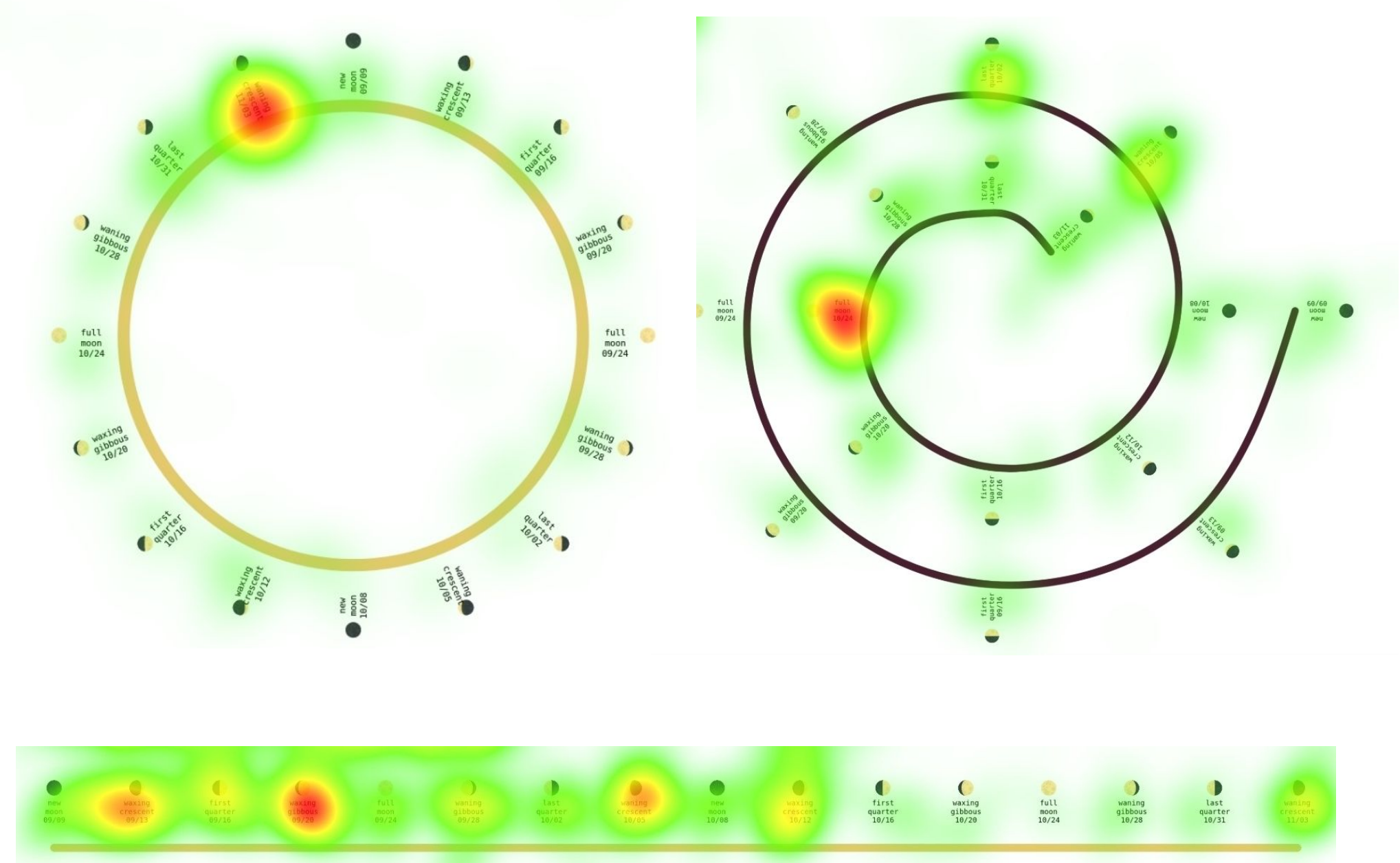
Results

The figure below shows the **average response time in seconds for each question we asked.** The white line shows the average time until fixation for one group of subjects.
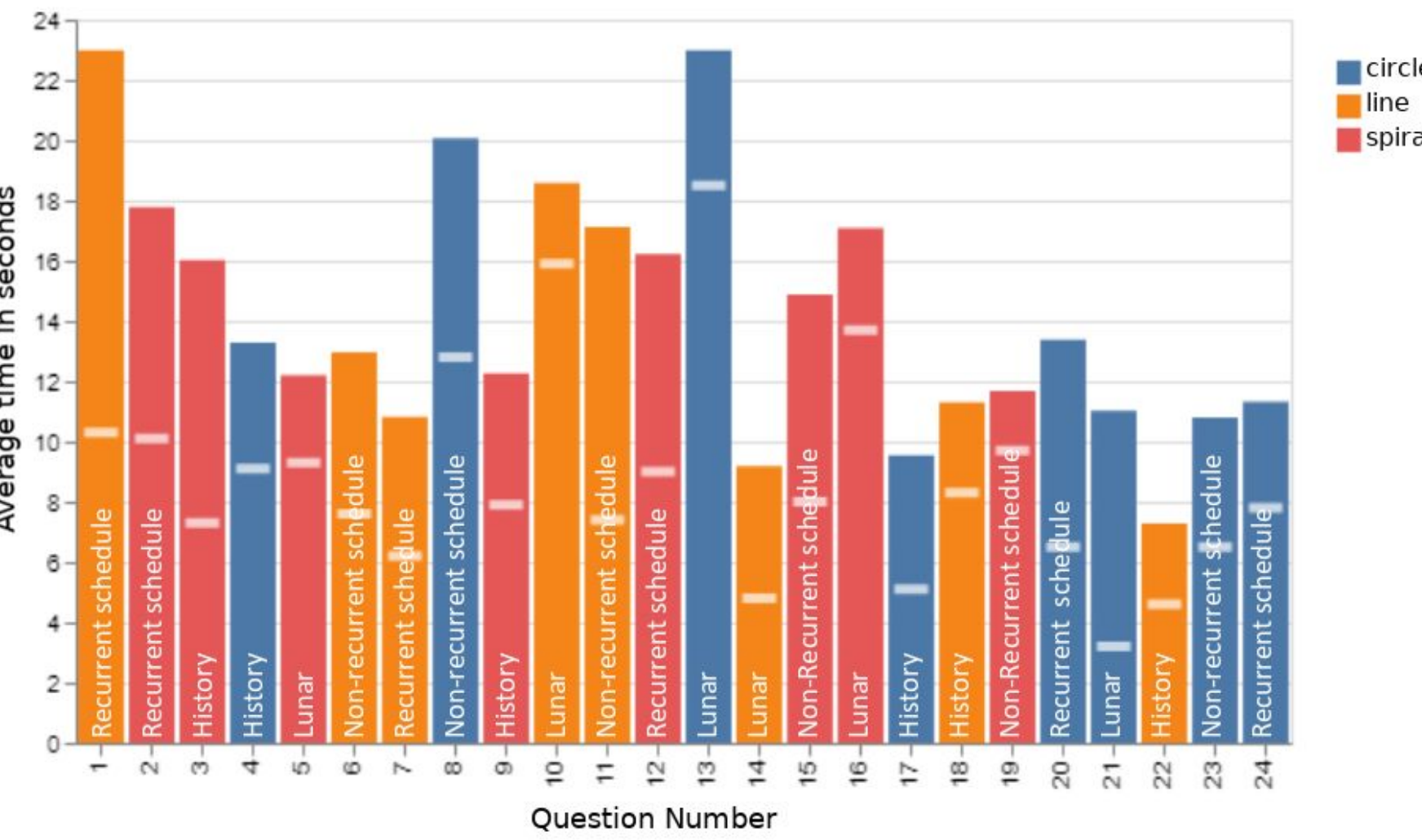
Three different groups were asked different questions. Best times across all groups and datasets:

	Group 1	Group2	Group3
History	linear	linear	circle
Lunar	linear	linear	linear
Recurrent Schedule	circle	linear	spiral
Non-recurrent Schedule	spiral	circle	linear

Participants were also asked to complete a survey rating each shape based on several parameters:
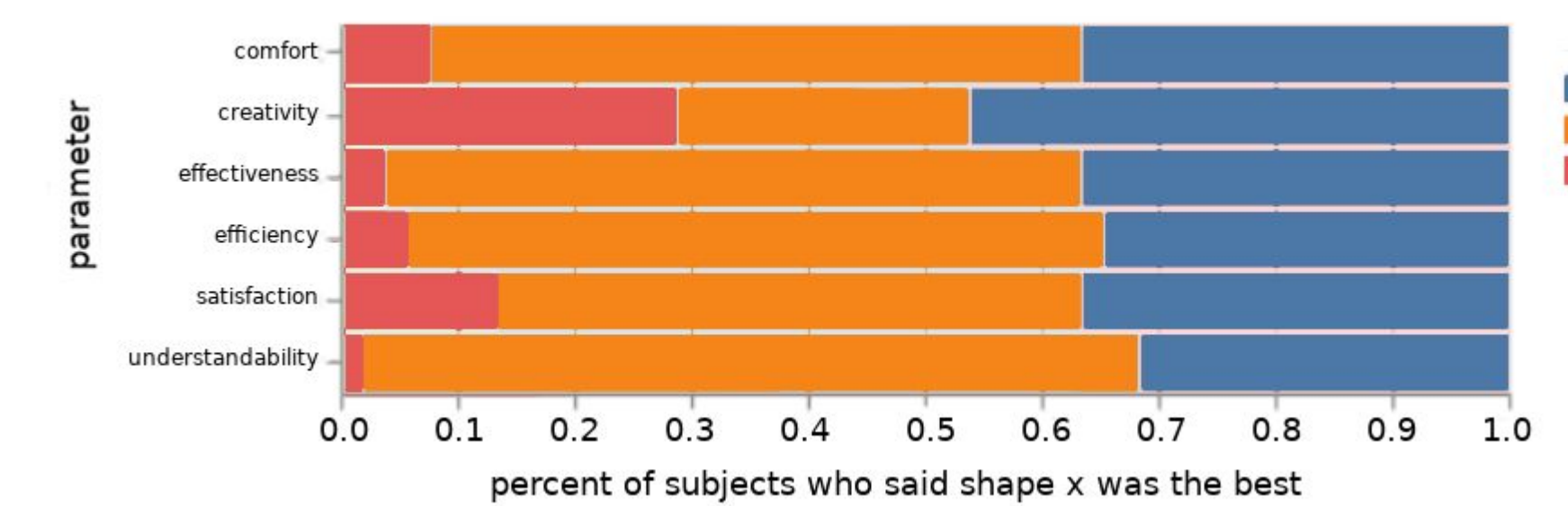
Conclusion

Unfortunately, **due to our high variance and small sample size we did not find any statistically significant difference** between any pair of timeline representations in a given dataset.

It is worth noting, though, that the pilot study has shown **significant promise in detecting and quantifying the effects that different timeline representations can have based on whether they visualize recurrent or non-recurrent data.**

There is potential in expanding this user study with a much larger sample size that could very likely yield statistically significant results. Moreover, the experiment could be further customized in the future without a lot of overhead to study how specific factors such as question difficulty, represented data volume and text orientation all contribute in the effectiveness of different timeline representations on recurrent and non-recurrent data.

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