

Digital Historical Research: An Ideal Case Study for Networked Visualisation Research

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Our Thesis

• Historians are a kind of intelligence analyst

- Therefore:
 - If we can design tools to aid the historical analysis process,
 - We can discover underlying principles and best practices for many other visual analysis tasks as well





What Do Historians Do?

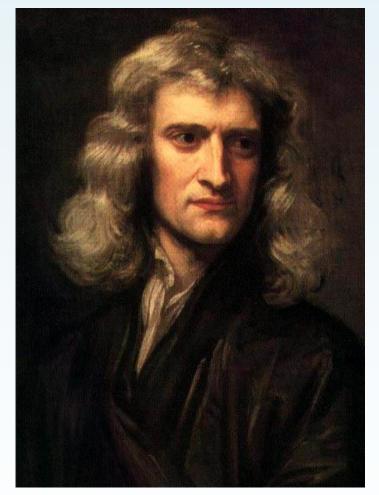
- A historian seeks *plausible explanations* for a set of facts
- These explanations links networks of evidence together
- The links are based on *informed opinion*
- Multiple explanations are always possible





A Brief History of Newton

- 4 January 1643 31
 March 1726
- Professor at Cambridge until 1696
- Warden of Royal Mint until 1726
- Wrote intensely about theological issues for much of his life



Godfrey Kneller portrait of Newton, 1689





The Newton Corpus

- Transcribed by the Newton Project, University of Sussex
- Consists of more than five million words on a range of topics including:
 - Alchemy
 - Mathematics
 - Physics
 - Theology
 - Religious history

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Difficulties with Newton

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Some of the many; one document has more than 22,000 insertions and deletions





Structures of Documents

- Documents often "forked":
 - Started with bits of one document
 - Created later revisions using ambiguous cross-linking symbols
- Documents linked with other activities:
 - Later theological documents include mathematical notes on the revision to the *Principia*
 - Partial drafts of manuscripts also appear on the back, or even between the lines, of draft letters to Treasury Officers





Location of the Documents

- Individuals in the 18th century sifted through material to develop publishable manuscripts
- Large private collections were broken up in the 19th century
- Wide-spread sale of even small fragments across the entire globe in the 20th century





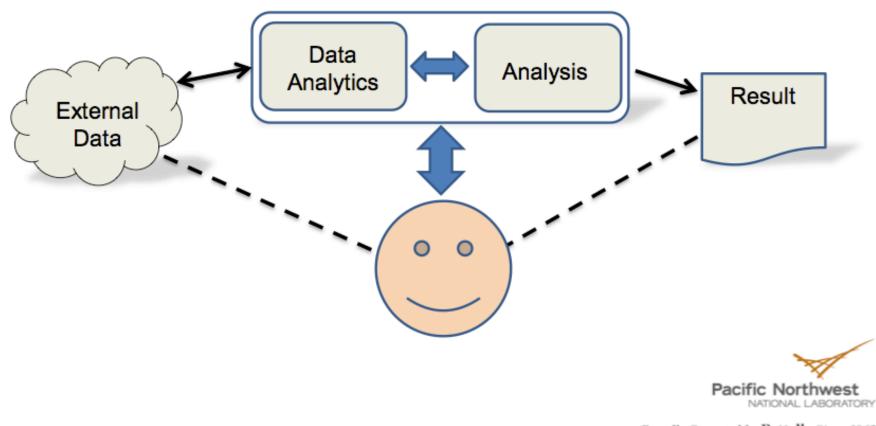
Dealing with Newton

- Given these difficulties, the corpus cannot be read like a book
- Visual analytics techniques required





Structure of a Visual Analytics System



Proudly Operated by Battelle Since 1965

From "National Visualization and Analytics Center: Evolving to Meet World Needs", Richard May, VASW 2010

External Data Transcribed via XML

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Visualise Different Document Views

A short Schem of \the true/ Religion{.}

Religion is partly essential 'fundamental' & immutable partly circumstantial & mutable. The first was the Religion of Adam, Enoch, Noah, Christ Abraham Moses Christ & all the saints & {illeg} consists of two parts 'our duty towards God & our duty towards man or

piety & righteousness, Illegible deletion (Extent: 2 characters) Divinity consists ir Cancelled

& /Godliness &\ Humanity.

Of Godliness.

Divinity 'Godliness' consists in the knowledge love & worship of God, Humanity in the love, & charity to man. 'righteousness' & good offices towards man. Thou shall love the Lord thy God wth all thy heart & with all thy Soul & wth all thy mind: this is the first & great commandment & the second is like unto it. Thou shalt love thy neighbour as thy self. On these two commandments hang all the law & the Prophets. Mat. 22. The first is enjoyned 'eouehed' /enjoyned\ in the four 'three' \four' first commandments of the Decalogue & improved in the fourth & the second in y^e four 'six' last.

Of Atheism

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A short Schem of the true Religion{.}

Religion is partly fundamental & immutable partly circumstantial & was the Religion of Adam, Enoch, Noah, Abraham Moses Christ & consists of two parts our duty towards God & our duty towards man or piety & righteousness, piety which I will here call Godliness & Humanity.

The editor is unsure of this reading because this text is unclear in the manuscript.

Of Godliness.

Godliness consists in the knowledge love & worship of God, Humanity in love, righteousness & good offices towards man. <u>Thou shall love the Lord thy God with all</u> thy heart & with all thy Soul & with all thy mind: this is the first & great commandment & the second is like unto it, Thou shalt love thy neighbour as thy self. <u>On these two commandments hang all the law & the Prophets</u>. Mat. 22. The first is enjoyned in the four first commandments of the Decalogue & the second in the six last.

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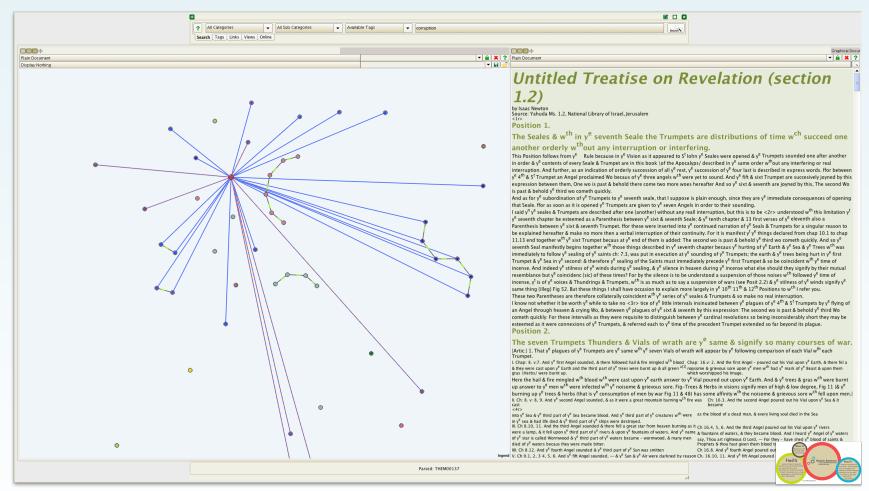
Normalized text

Diplomatic text





Visualise Keyword Linkages

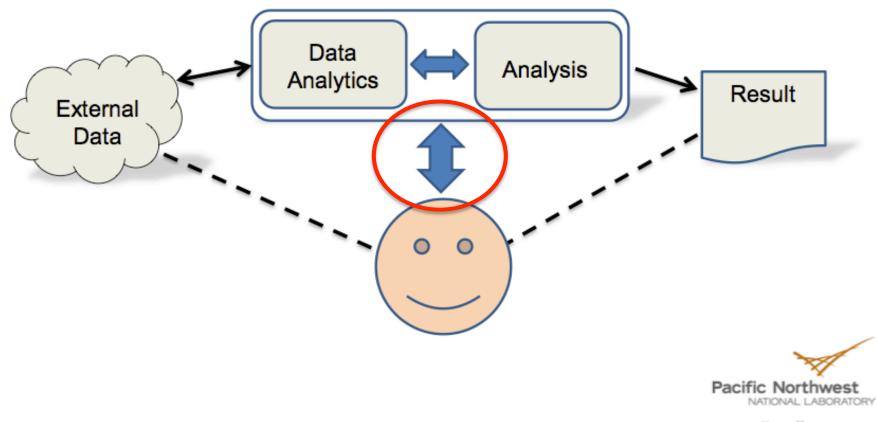


"Newton Spectrum", Henry Florence, Mayooran Nambiarooran, Ahmed El-Abiary, Yosef Dalbah, Dani Abdallah, Shannon D' Souza





The Missing Link...



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From "National Visualization and Analytics Center: Evolving to Meet World Needs", Richard May, VASW 2010





The Missing Link...

- Historical research means that the final, high-level arbiter of the quality of the inference is the human
- The system needs to support their mental model
 of activity
- These include:
 - Store parallel, competing hypotheses and means to browse between them
 - Store the assumptions inherent in creating those hypotheses
 - Provide methods to compare and contrast the differing network structures upon which they are based





Where Next?

- We are currently actively looking into two areas:
- Sensemaking:
 - Study of how people orient themselves in new environments
- Retroduction:
 - Study of how people develop novel hypotheses from surprising data





Summary

- Historical research involves looking for (often tenuous) relationships in mountains of data
- Most relationships have to be established by informed opinion
- Visual analysis tools can be used to help manage and display the information
- However, there are still huge challenges in how such systems interact with the mental models of end users