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
Difficulties with Newton

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 18\textsuperscript{th} century sifted through material to develop publishable manuscripts

• Large private collections were broken up in the 19\textsuperscript{th} century

• Wide-spread sale of even small fragments across the entire globe in the 20\textsuperscript{th} 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

From “National Visualization and Analytics Center: Evolving to Meet World Needs”, Richard May, VASW 2010
Paradoxical Questions concerning morals & actions of Athanasius & his followers

See this copy by Sir I. Newton ending with these words ought to be corrected

Paradoxical Questions

Whether ignominious death of Arius in a bog-house was not a story put about by Athanasius after his death?

How Arius died I recon a question of the moment leads to other things of moment I chuse to begin with it. This man propound it begin with it.

We are told in history the Council of Nice was excommunicated by the Emperor Constantine by banished by recanting was restored again into communion.
A short Scheme of the true Religion.

Religion is partly essential, fundamental, and immutable partly circumstantial, and mutable.

The first was the Religion of Adam, Enoch, Noah, Christ, Abraham Moses Christ's, and all the saints. It consists of two parts: our duty towards God and our duty towards man, or piety and righteousness.

Divinity consists of Godliness and Humanity.

Divinity consists in the knowledge love, and worship of God, Humanity in the love, and charity towards man, righteousness, and good offices towards man. Thou shalt love the Lord thy God with all thy heart, and with all thy mind; this is the first and greatest commandment, and the second is like unto it. Thou shalt love thy neighbour as thyself. On these two commandments hang all the law and the Prophets. Mat. 22: The first is enjoined: which enjoined in the four first commandments of the Decalogue and improved in the fourth and the second in the fifth and the sixth last.

Of Godliness.

Godliness consists in the knowledge love, and worship of God, Humanity in love, righteousness, and good offices towards man. Thou shalt love the Lord thy God with all thy heart, and with all thy soul, and with all thy mind; this is the first and greatest commandment, and the second is like unto it. Thou shalt love thy neighbour as thyself. On these two commandments hang all the law and the Prophets. Mat. 22. The first is enjoined in the four first commandments of the Decalogue and the second in the six last.

Of Atheism.

Opposite to the first is Atheism in profession and Idolatry in practice. Atheism is so senseless and odious to mankind that it never had many professors. Can it be by accident, that all birds beasts, fish and men have two eyes of the same shape and size, but in their bowels, and just two eyes of the same shape and size: Wheyet, if there be any uniformity in the outward shapes but from the counsel and contrivance of an Author? Whence is it that the eyes of all sorts of living creatures are transparent to the very bottom and the only transparent members in the body, having on the outside an hard transparent skin, and within transparent juices with a crystalline globe in the middle, which the eye or papillae, in all of them so shaped, fitted for vision, that no Artist can mend them? Did blind chance know that there was light, what was its refraction and fit the eyes of all creatures after the most curious manner to make use of it? These and such like considerations always have and ever will prevail with man kind to believe that there is a being who made all things and has all things in his power and who is therefore to be feared.
Visualise Keyword Linkages

The Missing Link…

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