

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

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THE NEWTON PROJECT

Our Thesis

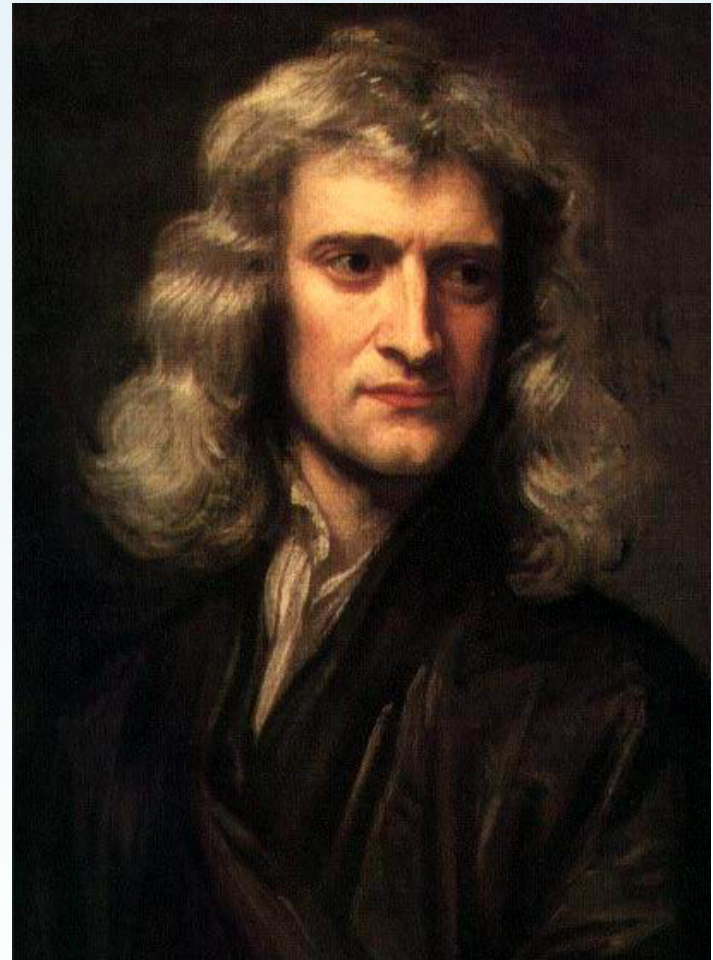
- Historians are a kind of intelligence analyst
- Therefore:
 - If we can design tools to aid the historical analysis process,
 - We can discover underlying principles and best practices for many other visual analysis tasks as well

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

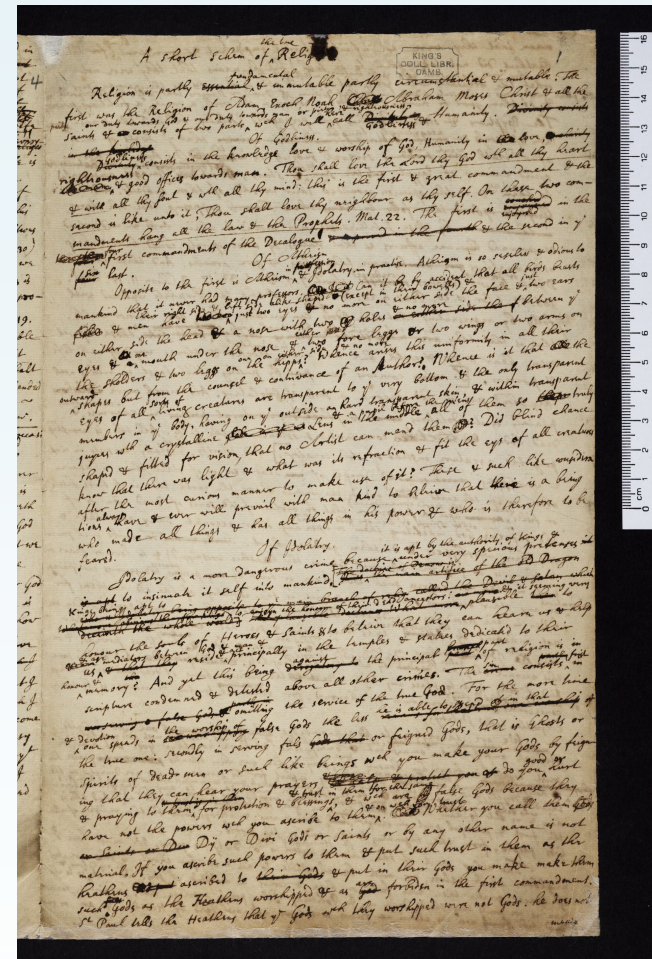
- 4 January 1643 - 31 March 1726
- Professor at Cambridge until 1696
- Warden of Royal Mint until 1726
- Wrote intensely about theological issues for much of his life



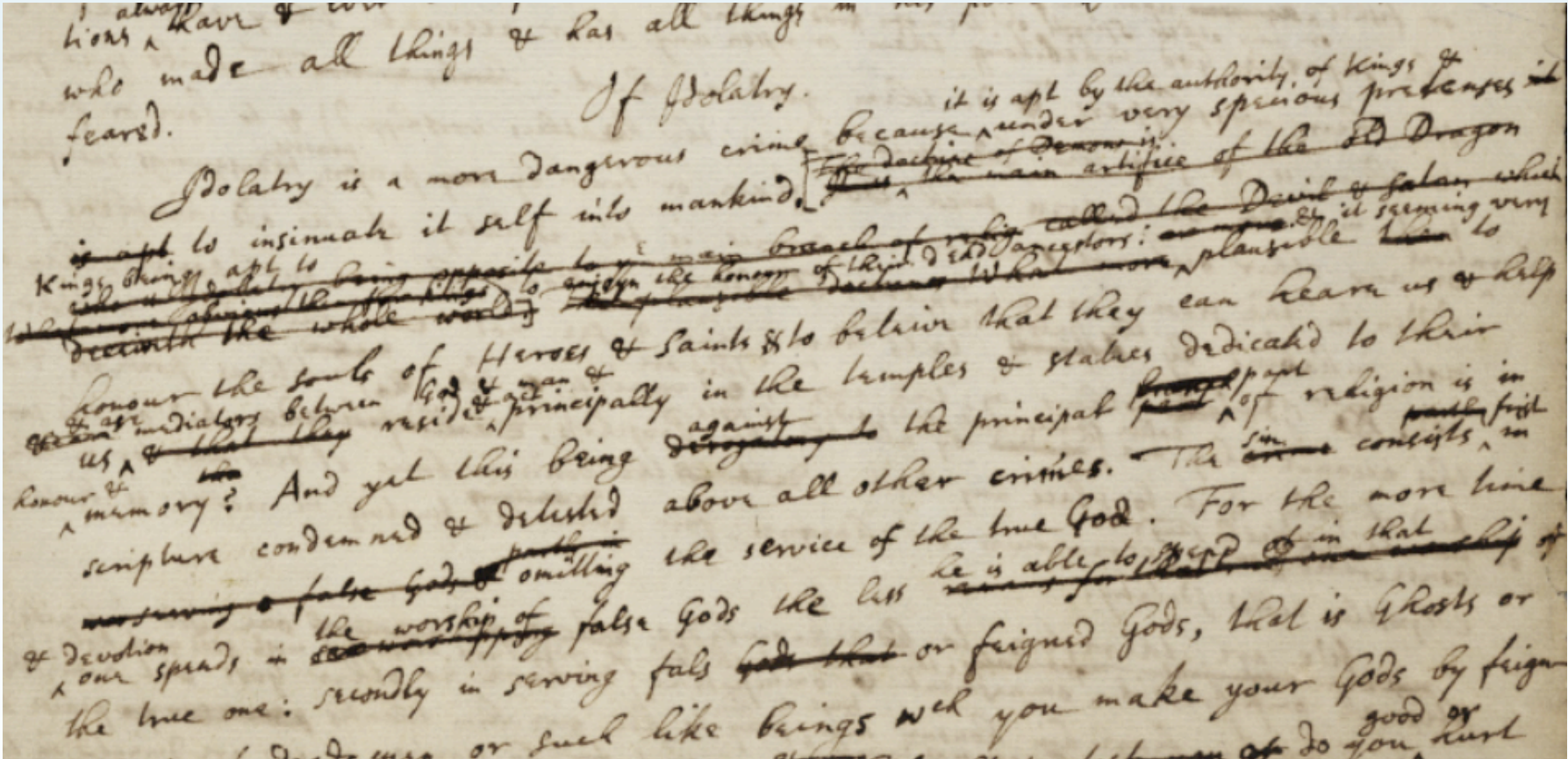
Godfrey Kneller portrait of Newton, 1689

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

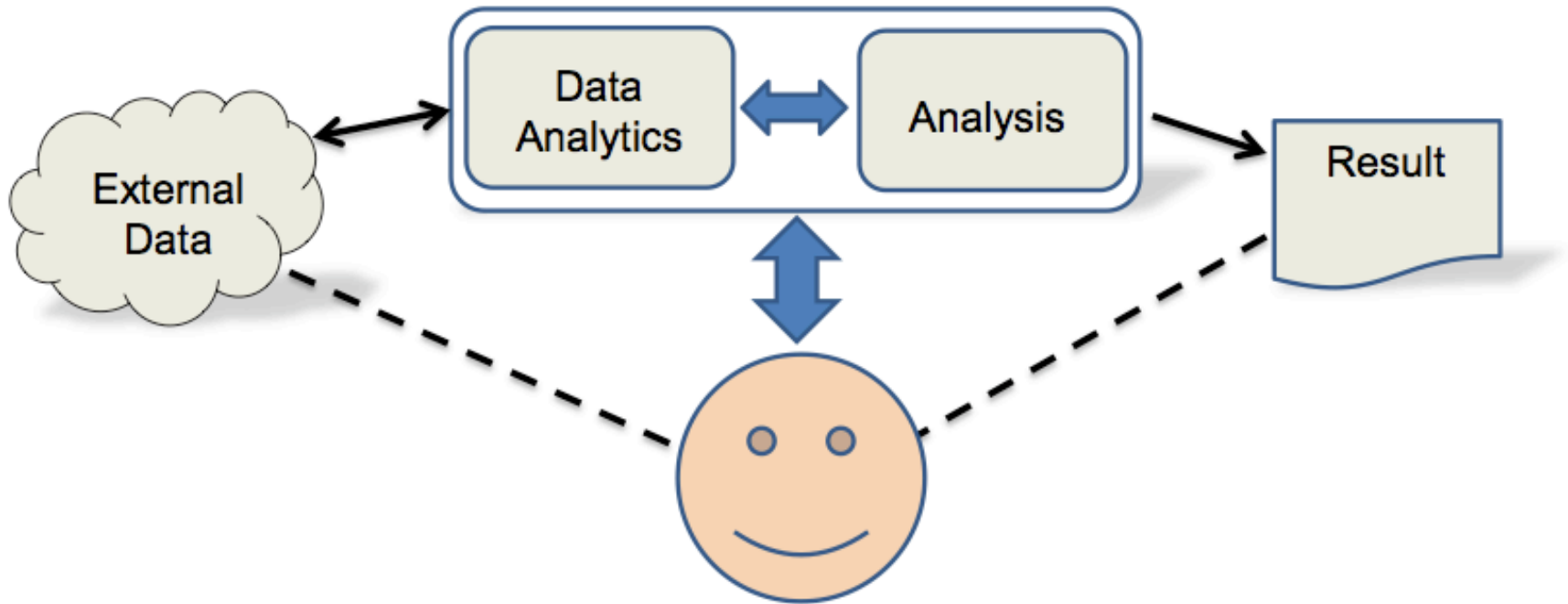
Location of the Documents

- Individuals in the 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



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

External Data Transcribed via XML

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<body>
<div>
<pb xml:id="p001r" n="1r"/>
<head rend="center">Paradoxical Questions <lb type="intentional"/>concerning <choice><abbr>y<hi rend="superscript">e</hi></abbr><expan>the</expan></choice> morals & actions of <lb/>Athanasius & his followers</head>
<p><add place="interlinear" hand="#jc" indicator="yes">See this copy by Sir I. Newton ending with these <lb/>words ought to be corrected</add></p>
<div>
<head rend="center">- - Quæst 1. <lb type="intentional"/>Whether <choice><abbr>y<hi rend="superscript">t</hi></abbr><expan>that</expan></choice> ignominious death of Arius <supplied reason="damage">in a bog-house</supplied> <lb/>was not a story put about by Athanasius abo<supplied reason="damage">ve twenty years</supplied> <lb/>after his death?
</head>
<p>How Arius died I reckon a question of <supplied reason="damage">no <del type="strikethrough">great</del> moment <add place="supralinear" indicator="yes">but</add></supplied> <lb/>because it <del type="strikethrough">leads in</del> <add place="supralinear" indicator="yes"><del type="strikethrough">gives light</del></add> <add place="supralinear" indicator="yes">leads</add> to other things of moment <supplied reason="damage">I chuse to</supplied> <lb/><del type="strikethrough">propound it</del> begin with it. <del type="strikethrough">This man</del> <add place="supralinear" indicator="yes">We are told in history <supplied reason="damage"><choice><abbr>y<hi rend="superscript">t</hi></abbr><expan>that</expan></choice> he</supplied></add> was <supplied reason="damage">excommunicated by</supplied> <lb/>the Council of Nice & <del type="strikethrough">& be</del> <add place="supralinear" indicator="yes">being banished by</add> <lb/>upon <supplied reason="damage">recanting</supplied> was restored again into commu<supplied reason="damage">nion</supplied> <gap reason="damage" extent="unclear"/> <lb/>of Tyre & then</del> <add place="supralinear" indicator="yes"><choice><sic>banishished</sic><corr>banished</corr></choice></add> by <supplied reason="damage">the Emperor Constantine <choice><abbr>y<hi rend="superscript">e</hi></abbr><expan>the</expan></choice>

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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)** & \Godliness & \ Humanity. Divinity consists in **Cancelled**

|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 shalt 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 **enjoyed** \eouched/ \enjoyed/ in the **four** ~~three~~ \three/ \four/ first commandments of the Decalogue & ~~improved in the fourth~~ & the second in y^e **four** \six/ last.

|Of Atheism|

Opposite to the first is Atheism \in {illeg} \profession/ & Idolatry in practise. Atheism is so senseless {sic} & odious to mankind that it never had many professors. **Can Is it** Can it be by accident that all birds beasts **fishes** & men have **two two** \their right side & left side alike shaped & (except in their bowells) & \ just two eyes & no more on either side the face & \just two ears on either side the head & a nose with two **ey** holes ~~on either side the f~~ & no more/ between y^e eyes & a \but one/ mouth under the nose & \either just two fore leggs & \or two wings or two arms on the sholders & two leggs on the hipps \one on either side & no more? Whence arises this uniformity in all their \outward/ shapes but from the counsil & contrivance of an **a** \Author? Whence is it that **all** the eyes of all \sorts of/ living creatures are transparent to y^e very bottom & the only transparent members in y^e body, having on y^e outside an hard transparent skin, & within transparent juyces wth a crystalline **globe in y^e mi** Lens in the middle & a pupil before the Lens/ all of them so **shape** truly shaped & fitted for vision, that no Artist can mend them, {illeg}? Did blind chance know that there was light & what was its refraction & fit the eys of all creatures after the most curious manner to make use of it? These & such like considerations

Diplomatic text

<|>

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.

Of Godliness.

Godliness consists in the knowledge love & worship of God, Humanity in love, righteousness & good offices towards man. Thou shalt love the Lord thy God with all 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. On these two commandments hang all the law & the Prophets. Mat. 22. The first is enjoyed in the four first commandments of the Decalogue & the second in the six last.

Of Atheism

Opposite to the first is Atheism in profession & Idolatry in practise. Atheism is so senseless & odious to mankind that it never had many professors. Can it be by accident that all birds beasts & men have their right side & left side alike shaped (except in their bowells) & just two eyes & no more on either side the face & just two ears on either side the head & a nose with two holes & no more between the eyes & one mouth under the nose & either two fore leggs or two wings or two arms on the sholders & two leggs on the hipps one on either side & no more? Whence arises this uniformity in all their outward shapes but from the counsel & contrivance of an Author? Whence is it that the eyes of all sorts of living creatures are transparent to the very bottom & the only transparent members in the body, having on the outside an hard transparent skin, & within transparent juyces with a crystalline Lens in the middle & a pupil before the Lens all of them so truly shaped & fitted for vision, that no Artist can mend them? Did blind chance know that there was light & what was its refraction & fit the eys of all creatures after the most curious manner to make use of it? These & such like considerations always have & ever will prevail with man kind to beleive that there is a being who made all things & has all things in his power & who is therefore to be feared.

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

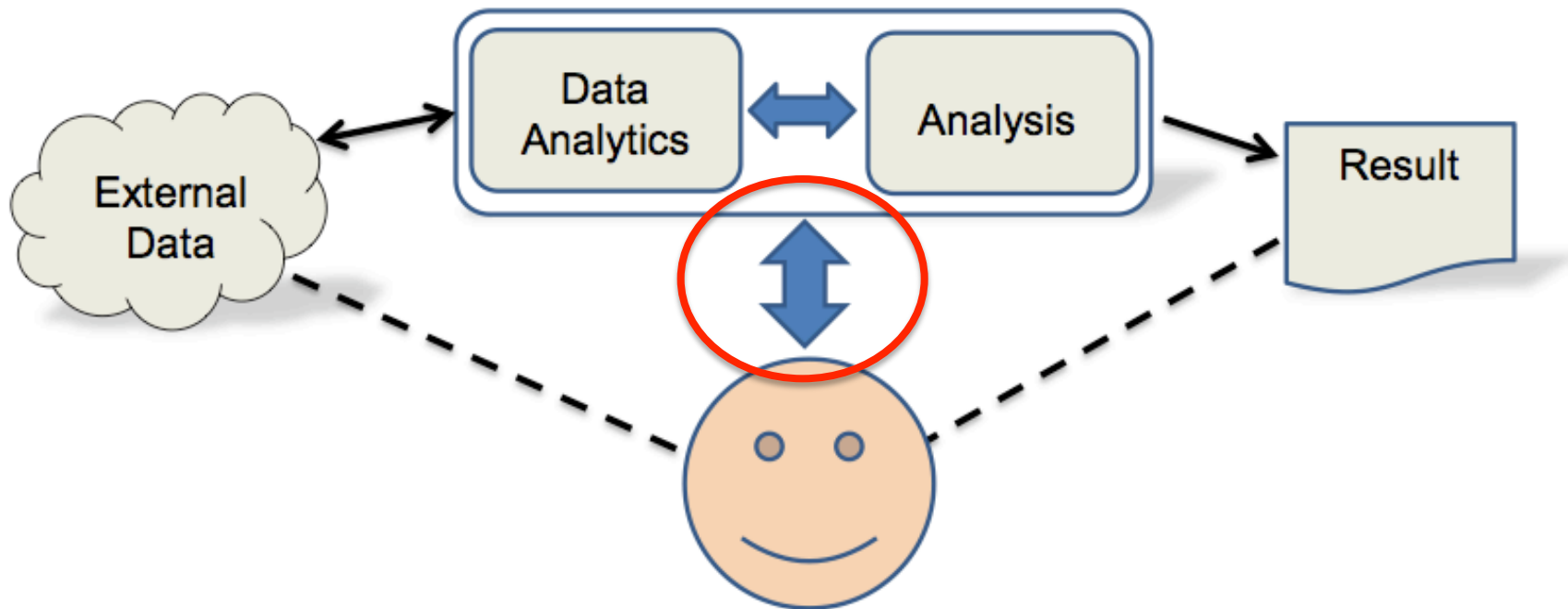
Normalized text

Visualise Keyword Linkages

The screenshot shows a software interface with a network graph on the left and a text document on the right. The graph features a central red node with numerous lines radiating outwards to other nodes, representing keyword linkages. The text document is titled "Untitled Treatise on Revelation (section 1.2)" and contains dense text with various references and footnotes. The interface includes a search bar at the top, a toolbar on the left, and a status bar at the bottom.

“Newton Spectrum”, Henry Florence, Mayoaran Nambiarooran, Ahmed El-Abiary, Yosef Dalbah, Dani Abdallah, Shannon D’ Souza

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
- Retrodution:
 - 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