On Expressing Observation and Interpretation through Visual Interaction

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Analytics is poised to become the next
general-purpose methodological science.

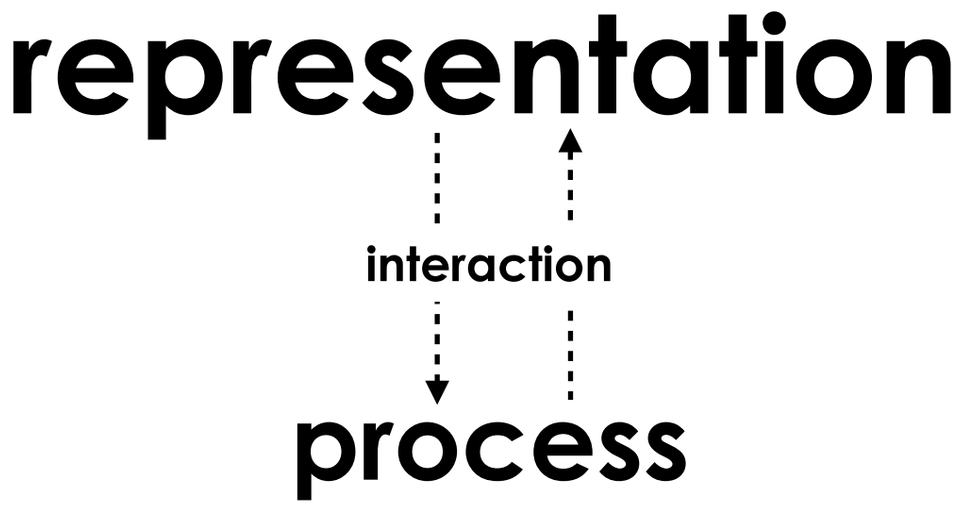
Interactive visualization is the face of analytics.
Visualization helps us share ideas about data.
Interaction helps us express and explore them.

It doesn't matter whether data is
quantitative or **qualitative**,
simple or **complex**,
big or **small**.
Is it *interesting* or *useful*
for human understanding?

Visual analytics research is increasingly focusing on
deeply **textured** data and **structured** information.

How can interactive visualization support
a comprehensive digital workspace
for humanities scholarship?

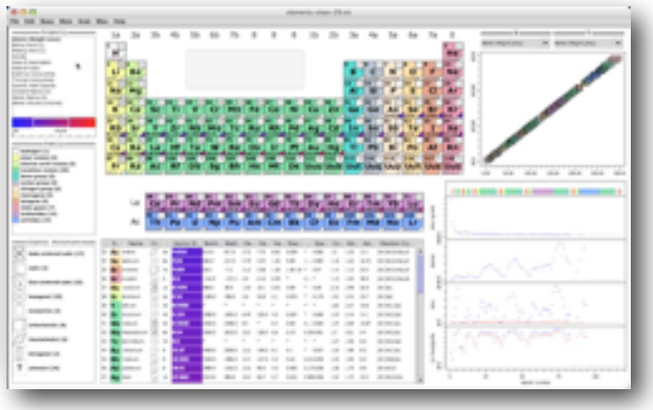
the visualization and humanities communities are still looking at the design of digital tools primarily in terms of

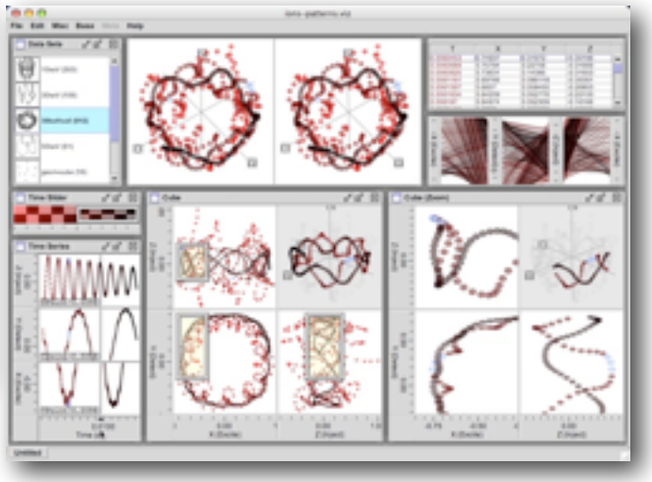


we need to ask two new, big questions about interaction

how does the visual representation of data affect how we can interact with it?

how can interaction allow us to express our ideas as data?



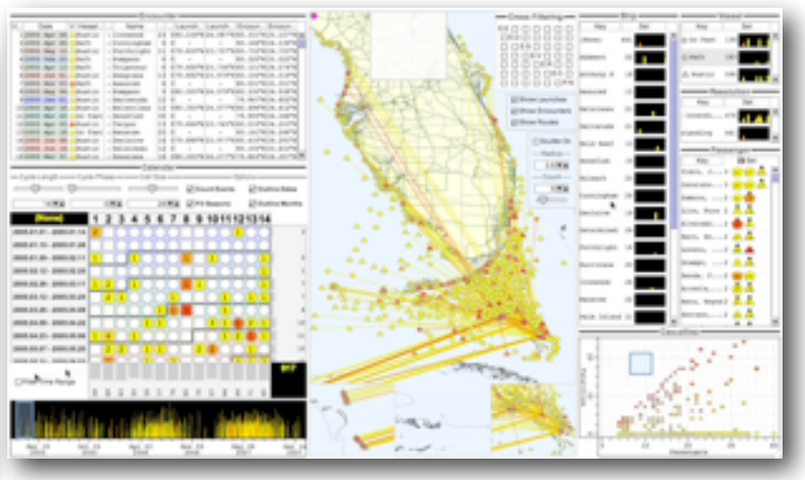


there are many well-known ways to
visually **encode** individual data items,
visually **represent** entire data collections, and
interactively **gesture** to navigate the resulting views

almost all interaction
with data items is either:
selecting items (in views)
adjusting values (in widgets)
labeling items (using a text box)

richer ways of interacting with
data items are app-specific:
paint an item with color
drop a pin on a map
type text in a form

how can we generalize this?



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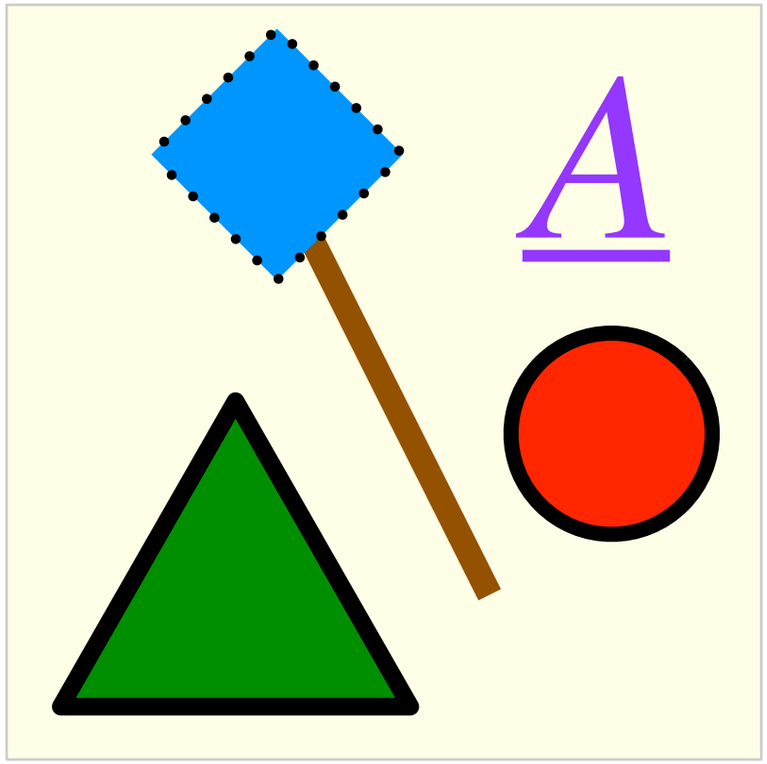


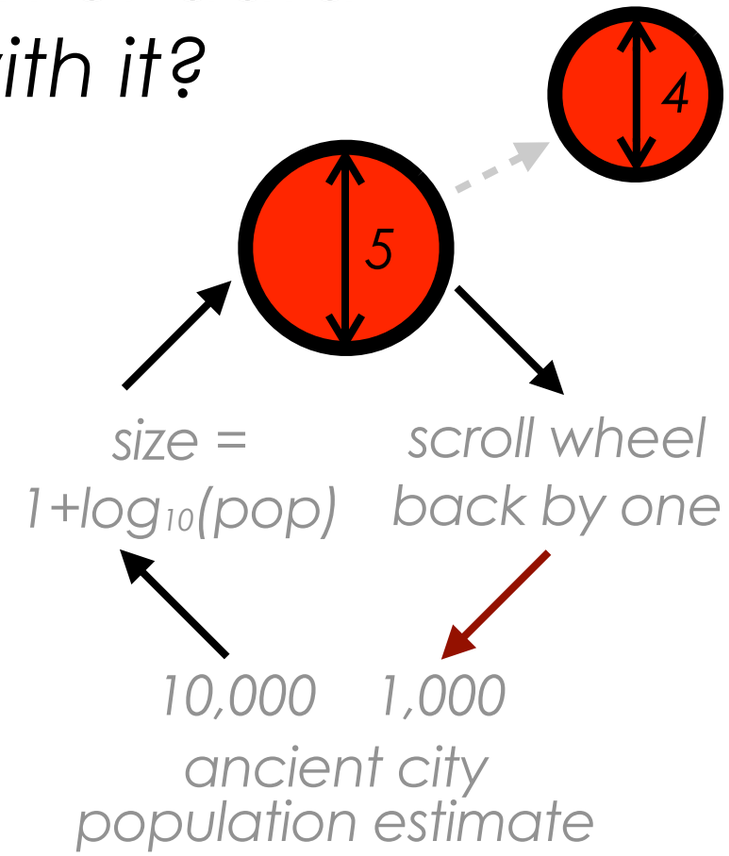
form follows function follows form...

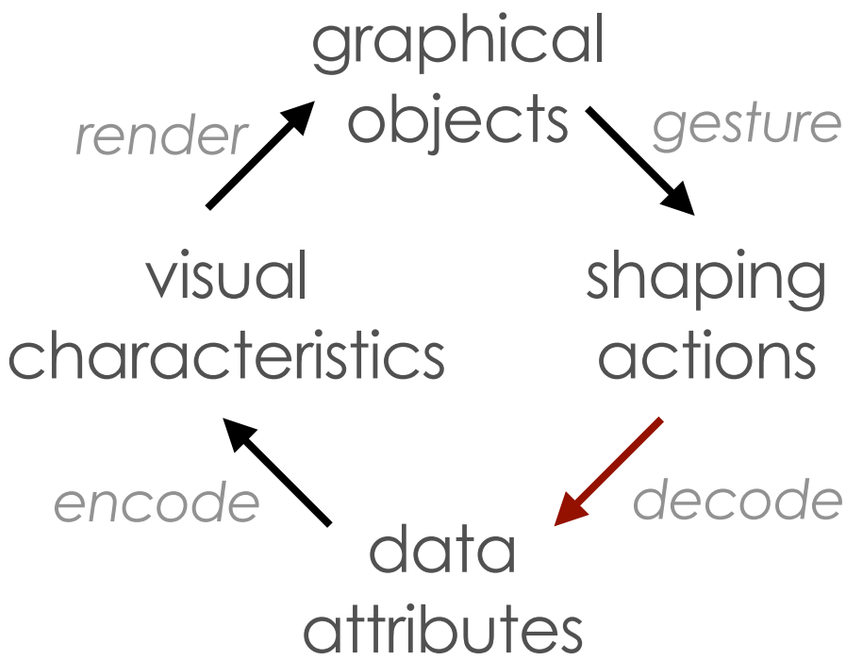
objects offer affordances for sensible interaction

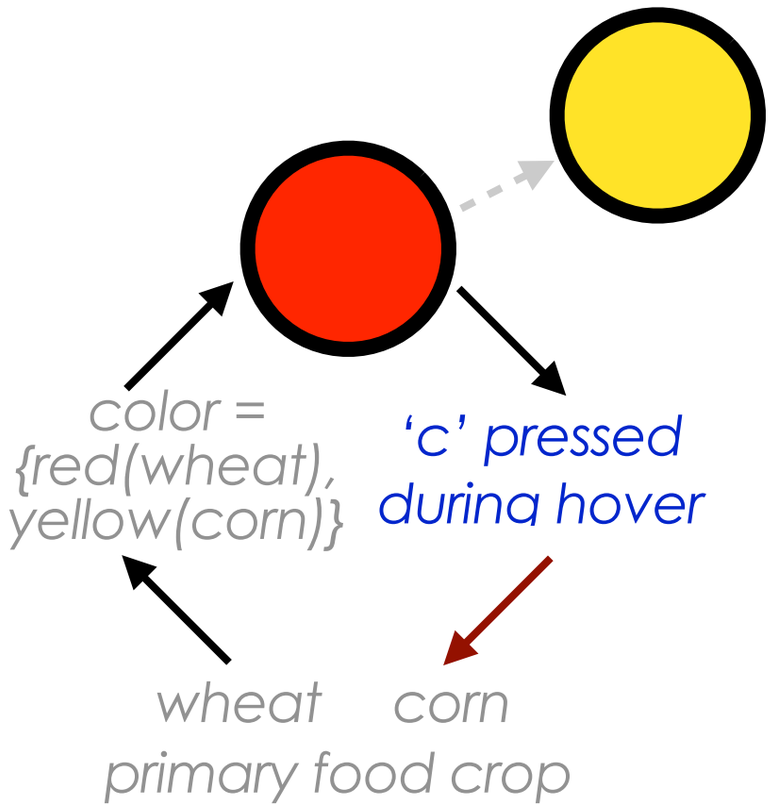
graphical characteristics constrain effecting movements

bounds of motion determine possible changes to data

but not necessarily via literal geometry







how does the visual representation of data affect how we can interact with it?

this is more than literal drawing

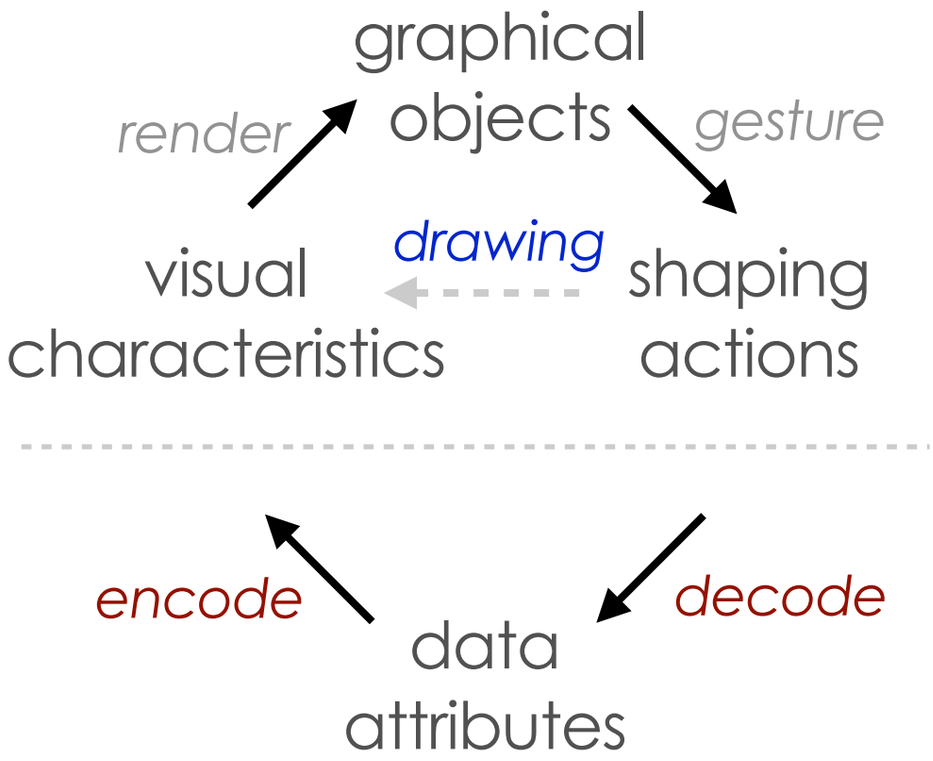
actions always change visual characteristics indirectly through data

objects and actions need not have corresponding geometries

to design an action, one must define a decoding function to sensibly "invert" the encoding

inversions are often ambiguous and sometimes impossible to solve in closed form

automatic algorithms can often solve them in practice by relaxing assumptions (as in the constraint-based UIs of the 80's)



indirectness provides design flexibility

encoding and decoding need not be exact inverse functions

it's enough if users can learn and use them together effectively

we're working on a declarative language for defining both

how can interaction allow us to express our ideas as data?

entities

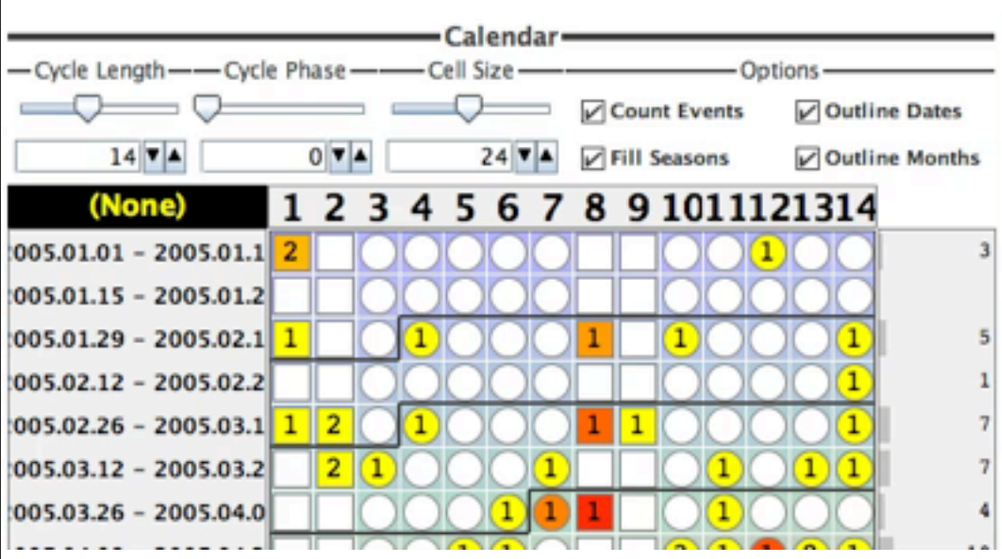
actions express characteristics

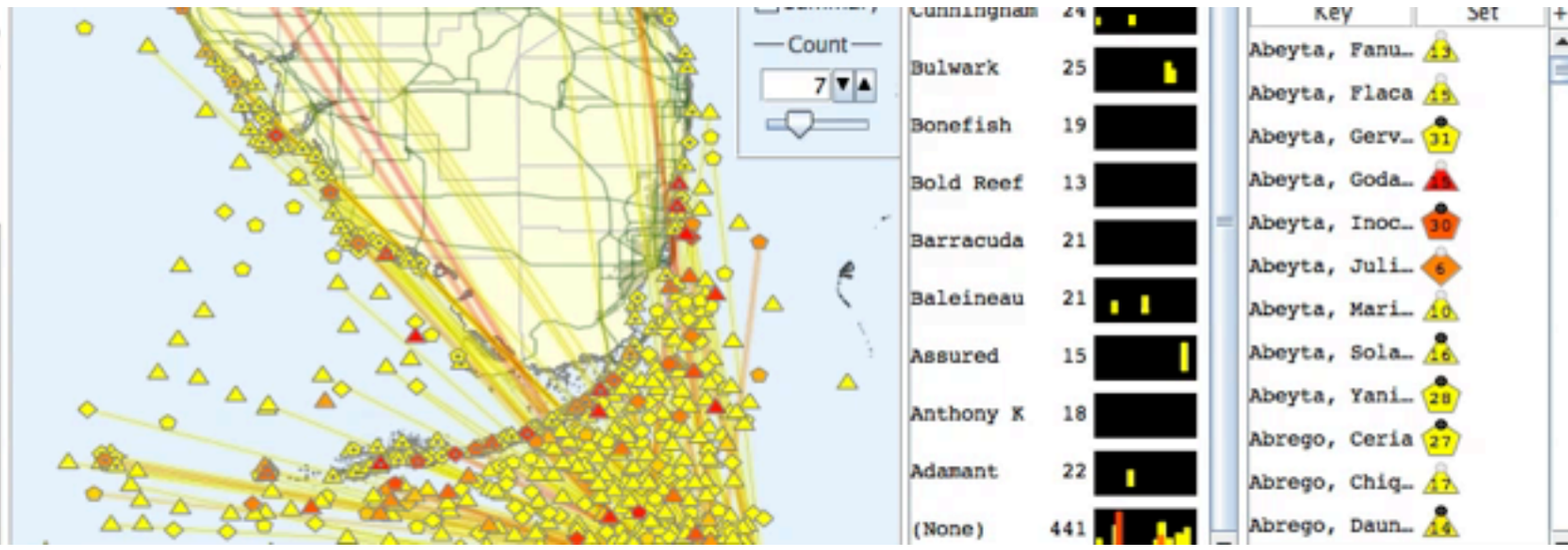
Drag things on a map to adjust location.

Nudge events to reorder them on a timeline.

Pinch to associate uncertainty with a measurement.

Click and type to name, label, or annotate.





relationships

actions express connections

Draw, move, erase arrows to edit links between items.

Press modifier keys to group or ungroup selected items.

Wheel scroll over an item to classify all items in its group.

Draw a path to sequence a set of locations over time.

how can interaction allow us to express our ideas as data?

reasoning

actions express comprehension

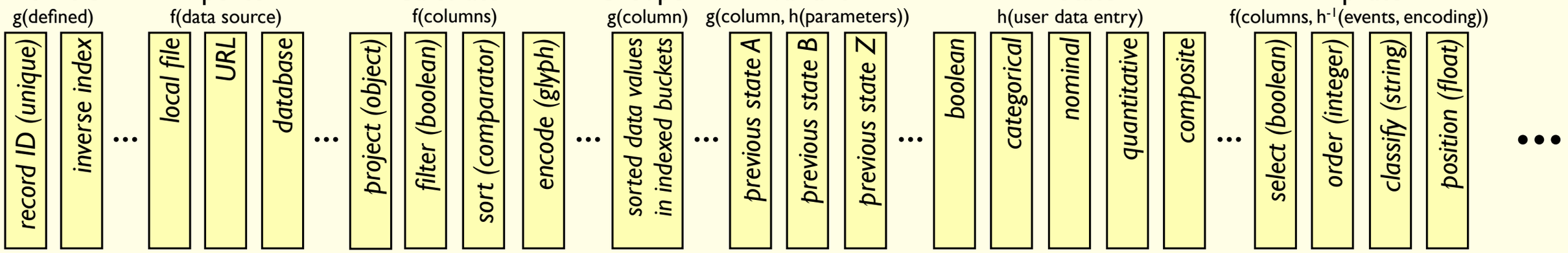
Change column values to record observations.

Create multiple columns to record other interpretations.

Define columns that transform, filter and sort others.

Aggregate and define categories using linked tables.

open-ended editing by defining and populating columns dynamically



sharing

actions express collaboration

Associate columns with users, times, and purposes.

Specify access and editing options for each column.

Define columns that adjudicate multiple interpretations.

Snapshot copies of columns for recall and export.

annotation shouldn't
be an endpoint

we think of annotation as

writing in the margin

adding a mark to a map

drawing an arrow to connect things

but in digital tools,
annotations are really data

in which writing is hand-formatted text

and symbols encode quantities

and arrows imply relationships

and in a sense,
all data is annotation

because whether by writing it down directly

or recording it with designed instruments

it ultimately comes from us...

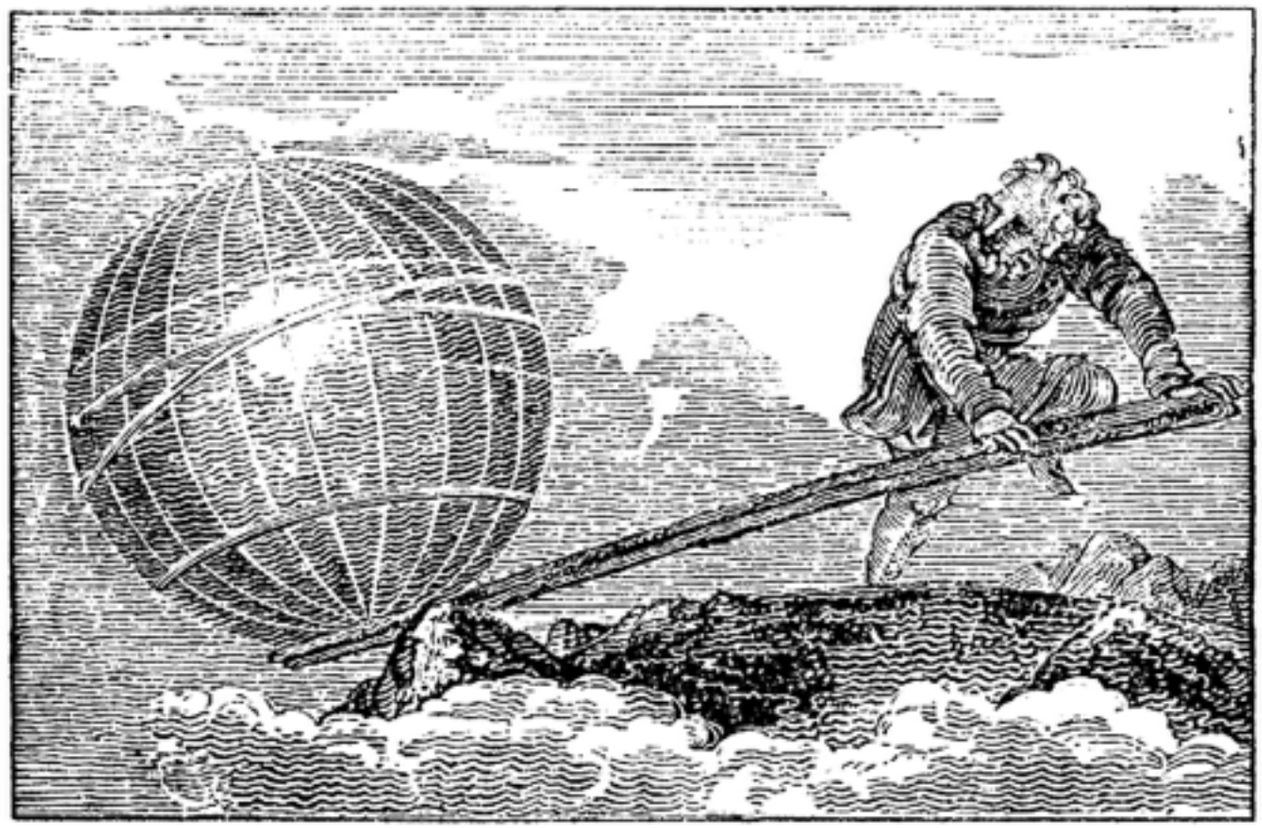
...interpreting the world

ampliation

open-ended, interpretation-driven
extension and modification of data
directly within visual representations

annotation as a part of open-ended interaction

to question, observe, reason, conclude, and share



www.math.nyu.edu/~crorres/Archimedes/Lever/leverBigCorners.gif

Ampliative
from Latin ampliare, "to enlarge"
used in logic to mean "extending" or "adding to that which is already known."

In Norman law,
an "ampliation" was
a postponement of a sentence
to obtain further evidence.

Interactive Gesture-Based Data Manipulation and Visualization for Exploratory Learning and Research

with a variety of DH collaborators at OU and Stanford

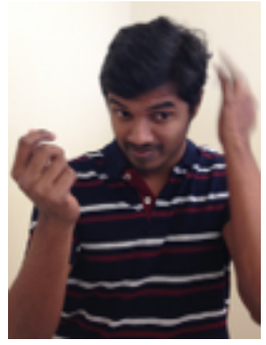
National Science Foundation

Emily Grimes

forms of data interaction in existing visualization tools

Jeyachandran Rathnam

a data editing architecture for web-based visualization



Library of Digital Latin Texts

with Sam Huskey (Classics) and June Abbas (SLIS) at OU

Andrew W. Mellon Foundation

Bharathi Asokarajan

pixel-based visualization of classical critical editions

Shejuti Silvia

storyline visualization of classical critical editions

Vamshi Krishna Sunchu

relational querying of TEI documents

Sudarshan Reddy Vangala

high-level provenance of interactive visual analysis

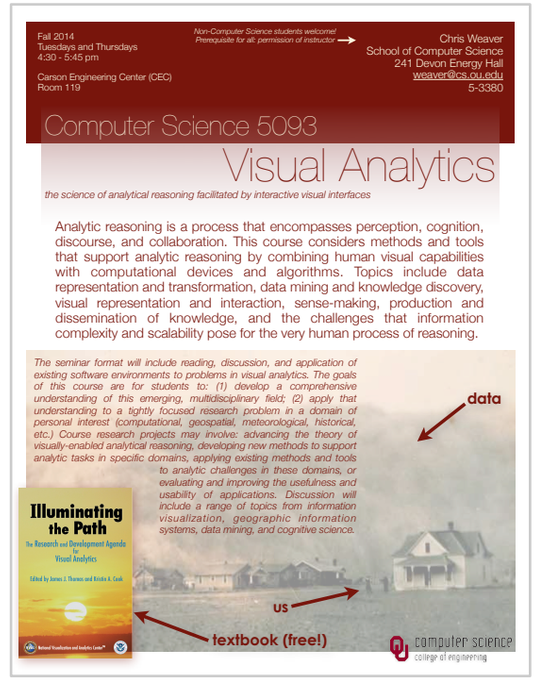
Our software workbench for creating visualizations is called Improvise.

To see more, visit
www.cs.ou.edu/~weaver/improvise

The next major version of Improvise is in planning. New features will include a data editing specification language and end-user ampliation capabilities.

Stay tuned!

Thanks!



Please tell students about CS 5093 Visual Analytics an old-fashioned seminar offered in Fall semesters. It's not just for CS students!