Learning From Spatiotemporal Stories With Storix - One Size Fits All?

Gunnar Misund, Håkon Tolsby and Øyvind Håkestad

Faculty of Computer Sciences
Østfold University College
Halden, Norway

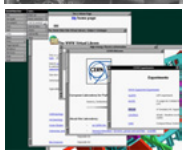
11th IASTED CATE
Hersonissos, Greece, September 30th, 2008

Outline

Storytelling

- Storytelling is a fundamental tool in education
- Today, most stories are non-orally distributed and consumed

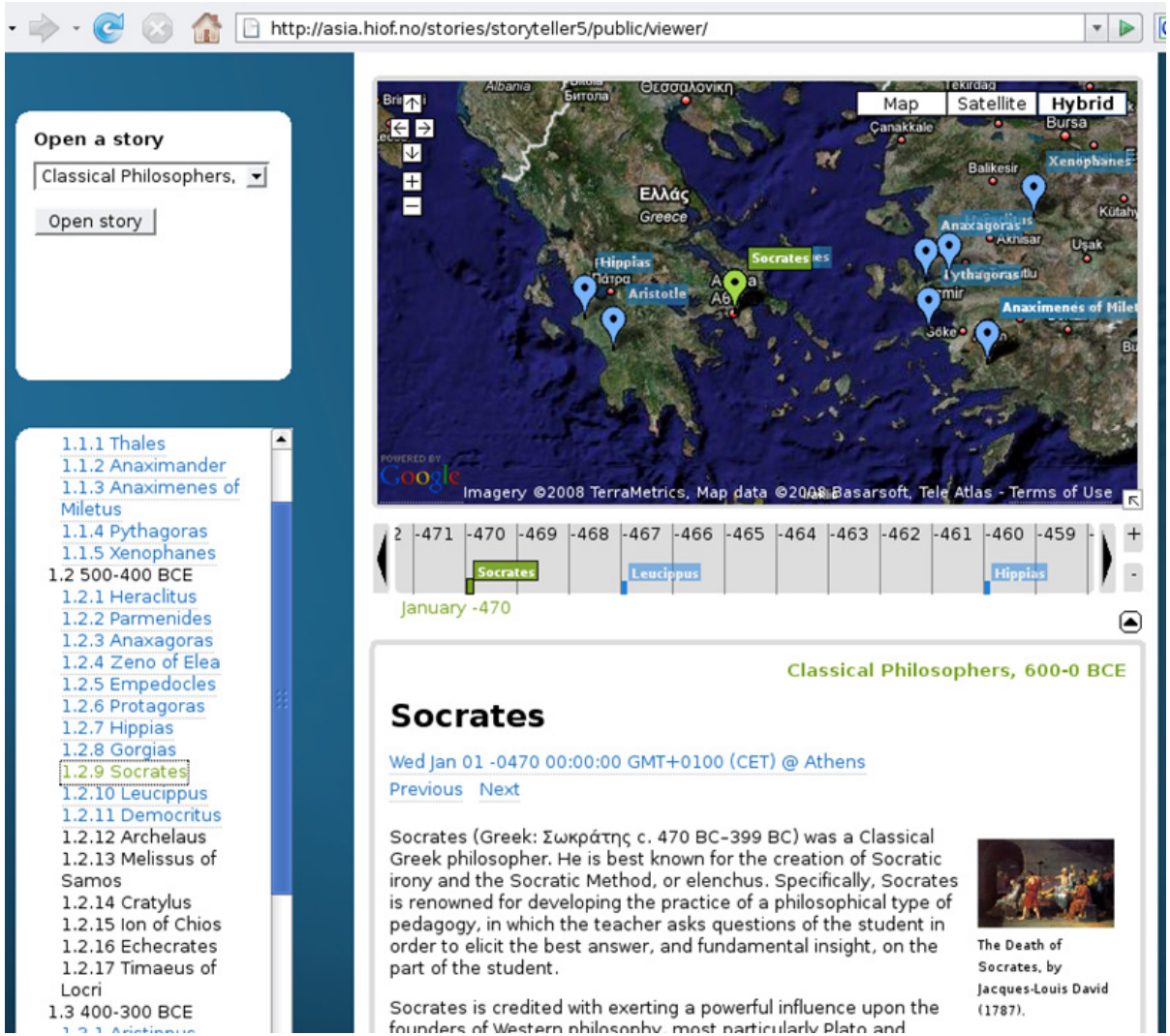
- Cave paintings, Lascaux, 13000 BC: Persistent stories
- Gutenberg, 1450: Mass distribution
- Roundhay Garden Scene, 1888: First movie
- John Logie Baird, Scotland, 1926: First TV broadcast
- Tim Berners-Lee, 1990: First Web browser



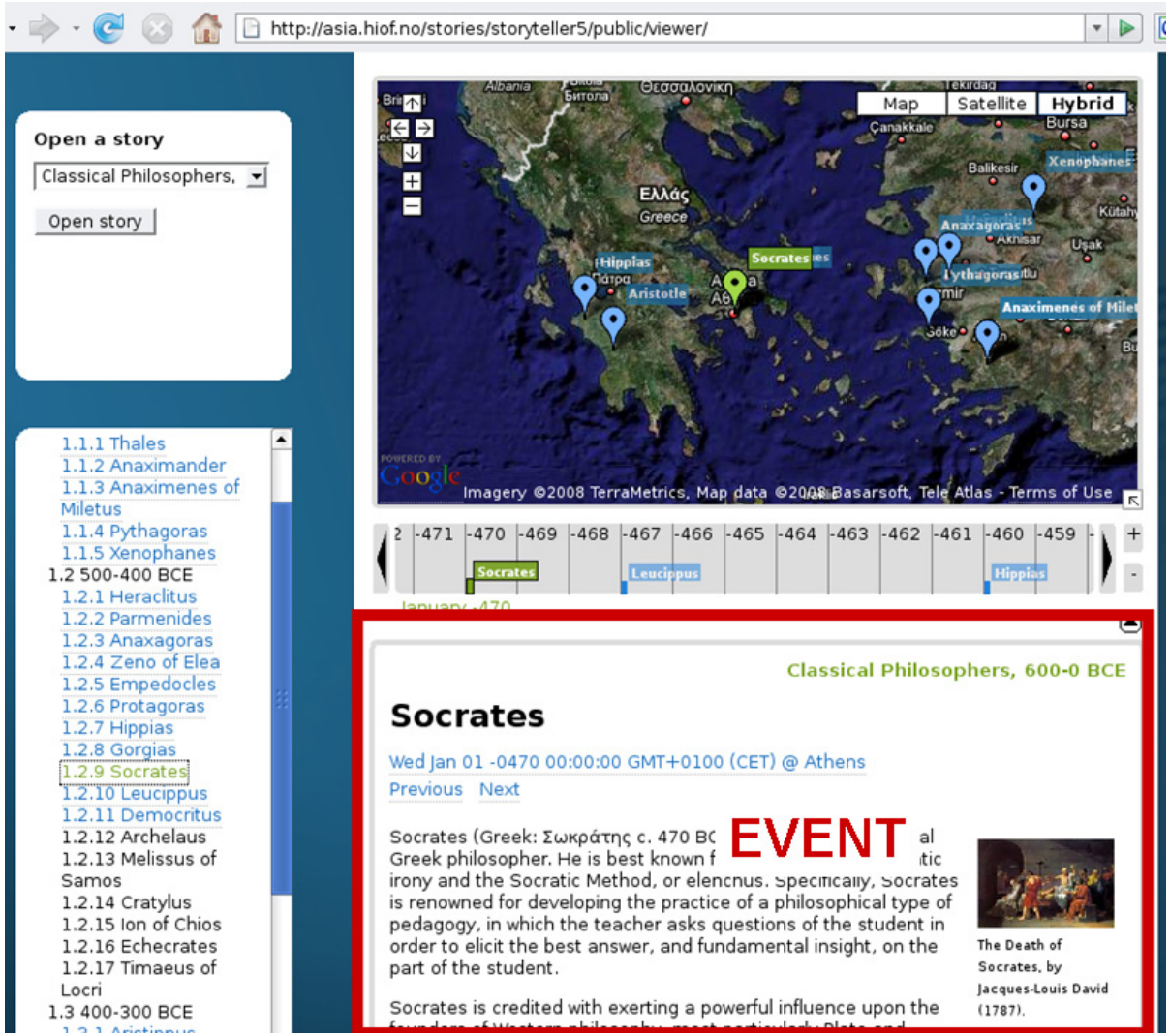
Story browsing

- All stories have a *structure*
- A common way to structure a story is to decompose it into atomic parts, often referred to as *events* [Bal, 97].
- However, events may be embedded in various *dimensions* (or *contexts*), for instance:
  - Narrative order (default)
  - Time
  - Space
- Stories may be accessed (browsed) along their dimensions:
  - Enhanced user experience
  - Novel insights [Eccles, 08]

Storix: A spatiotemporal story browser

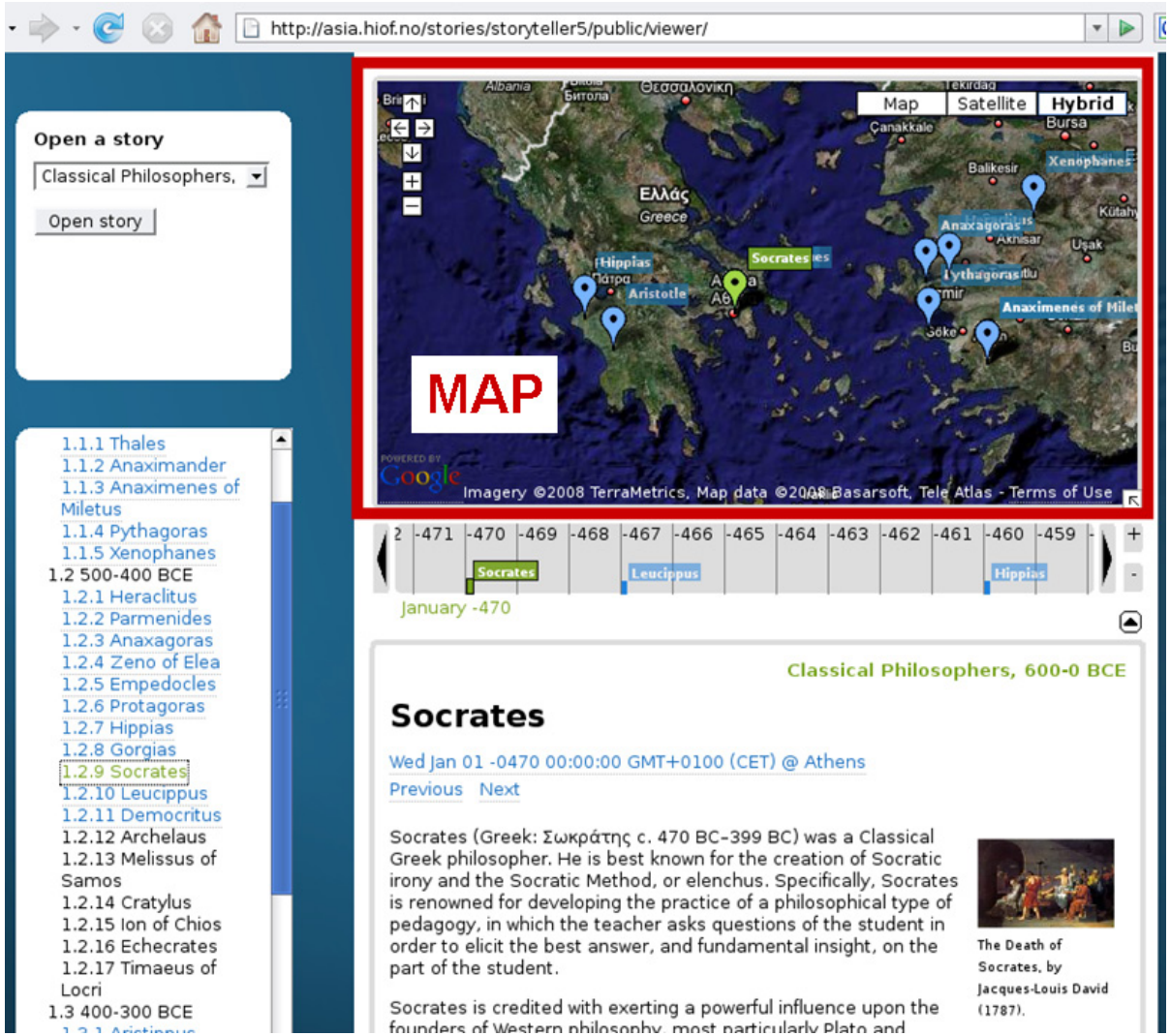


Storix: A spatiotemporal story browser



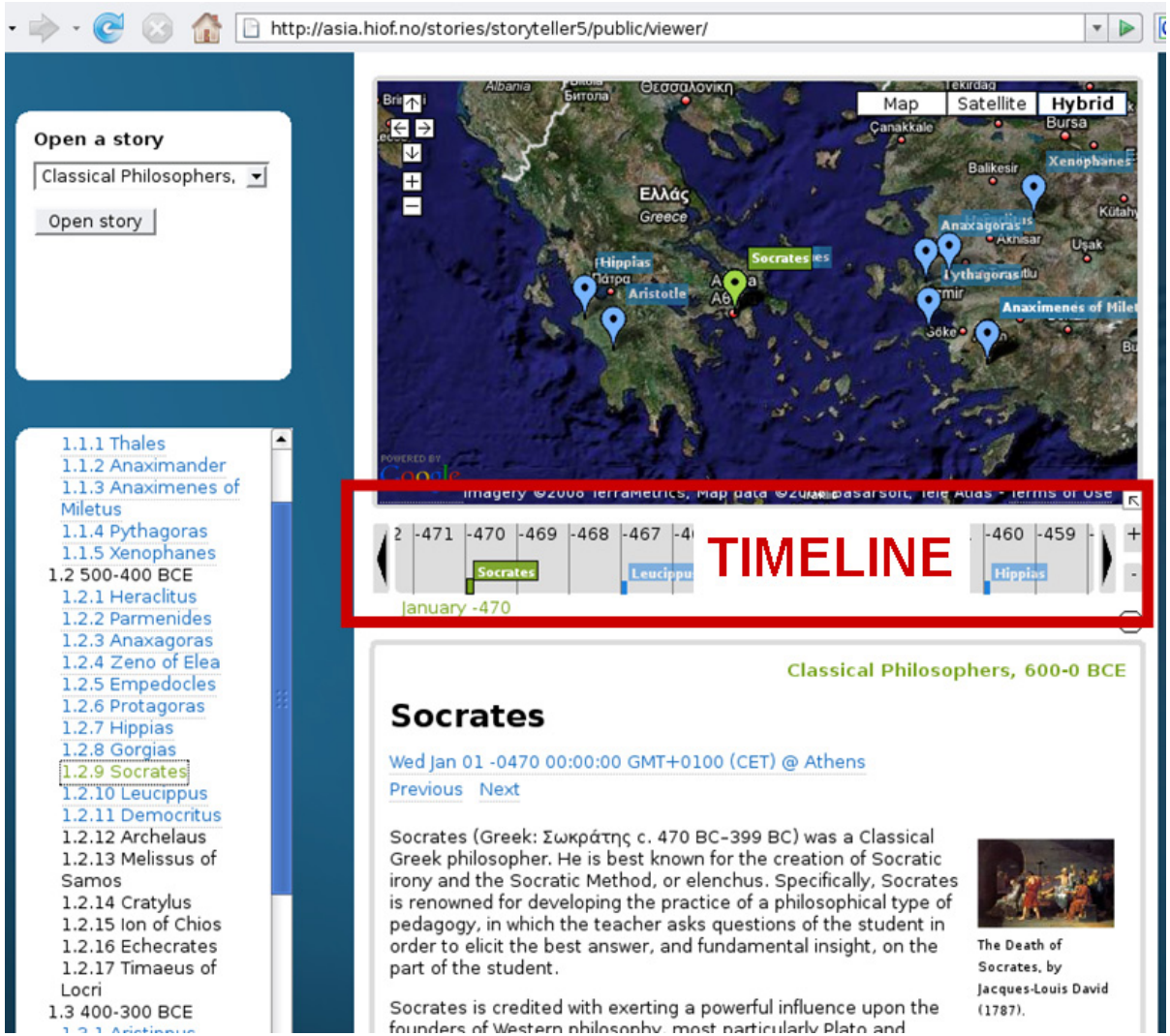
Event [Bal, 97]

Storix: A spatiotemporal story browser



Map

Storix: A spatiotemporal story browser



Timeline

Storix: A spatiotemporal story browser

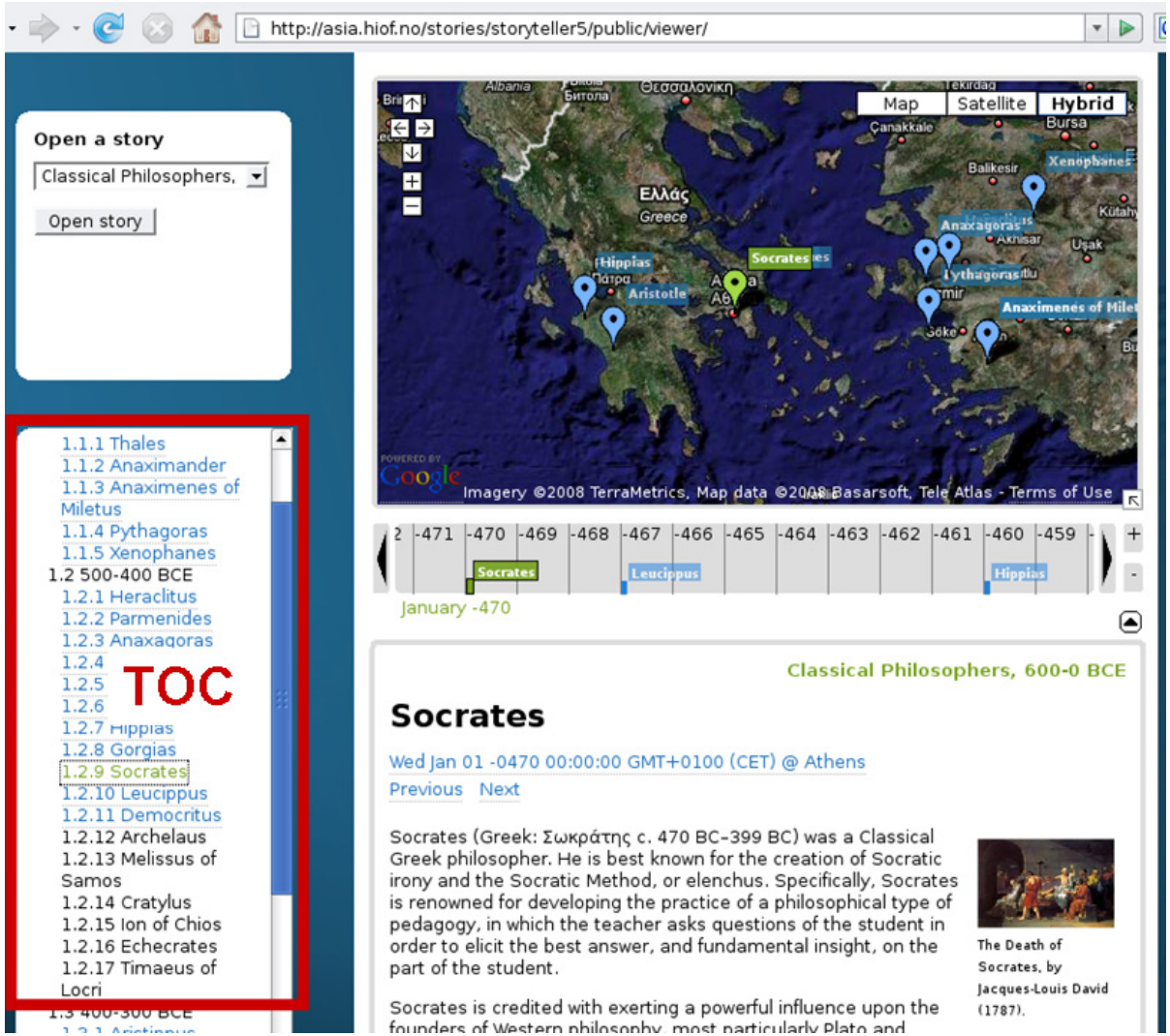
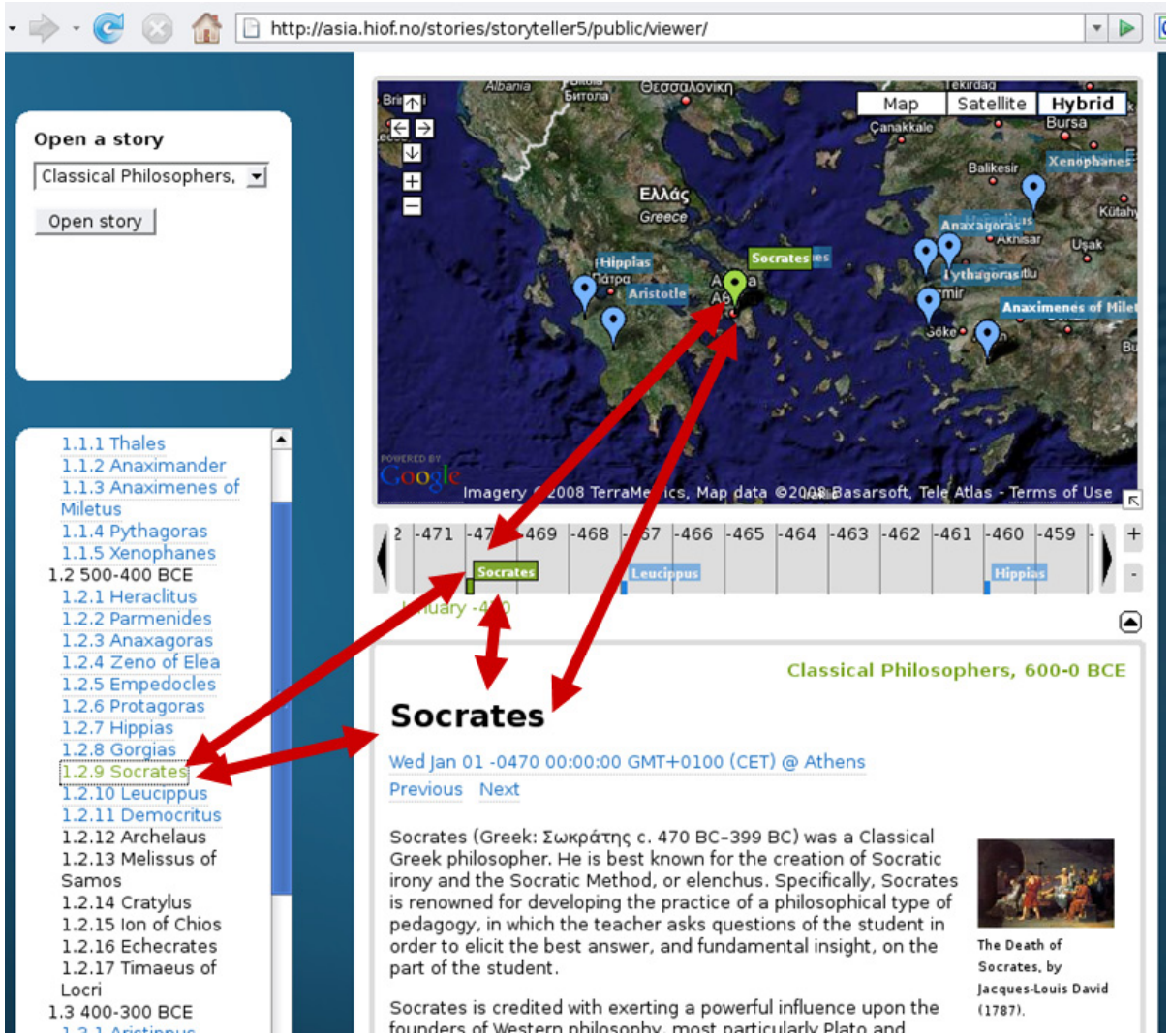


Table of content (TOC)

Storix: A spatiotemporal story browser



All story elements are synchronized: Clicking on a map marker updates event view, timeline and TOC, and so on.

Storix as a learning tool: Research questions

1. Will spatiotemporal story browsing, with a rich and potentially confusing interface, work in a realistic educational setting in primary school?
   - Will they manage to operate the tool?
   - Will the tool provide satisfactory learning outcomes?
2. Will spatiotemporal stories favor particular learning styles?

Setup (1)

- Grade seven class (11 yrs), 8 girls, 6 boys
- “Regular” class setting: Lecture in local history (however, on our campus)
- Activity: Solving tasks by browsing a spatiotemporal story

Setup (2)

- Teams of two
- 10 min Storix intro, 20 minutes assignment
- Assignment: 23 tasks, given on sheets of paper; combination of crossword (11 tasks), filling out missing words in statements (8) and questions (4)
- Some tasks encouraged map searching, others were temporally biased, and yet others inquired examination of textual content

The story

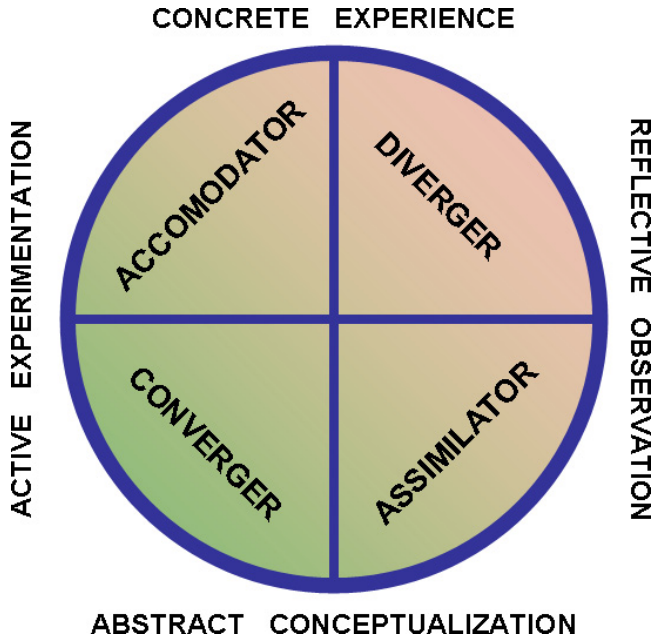
- Fredriksten Fortress, Halden, Norway
- 25 events; some only text, other combination of text and image(s)
- Time span: 111 year (1659 - 1770)
- Geographic area: Approx one square kilometer
- Focus on buildings and their associated events

Data collection

- Observations
- Teacher interviews
- Click data: All clicks recorded with team ID, event number, timestamp, and origin (map, timeline, TOC)
- Evaluation of committed assignments
- Assessment of the teams' learning styles

Learning styles: Convergers and Divergers, 1

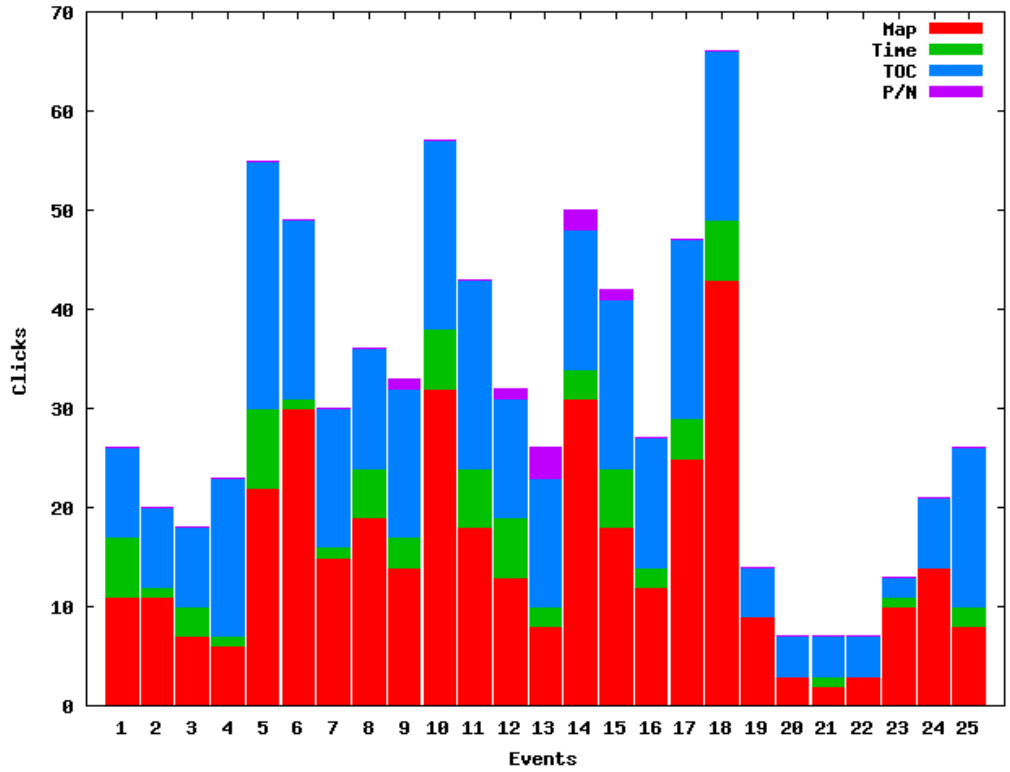
- Kolb's four types of "learning styles"[Kolb, 84]:
  1. Accomodator
  2. Diverger
  3. Assimilator
  4. Converger
- The teacher was asked to categorize the teams based on his knowledge of how they performed in regular educational contexts
- The teacher identified four groups as *Convergers*, and four as *Divergers*, and none as *Assimilators* or *Accomodators*



Learning styles: Convergers and Divergers, 2

- *Convergers*:
  - Pragmatists favoring abstract conceptualization and and active experimentation.
  - Solve problems relying on methodical and predictable approaches
  - They often achieve good scores
- *Divergers*:
  - Reflectors preferring concrete experience and reflective observation
  - Approach problem solving in a more nonlinear and unpredictable fashion
  - Normally not among the best performers
- The absence of *accomodators* and *assimilators* may reflect class room practise were neither theoretical conceptualization nor pure practical tasks are emphasized.

Click categories for each event

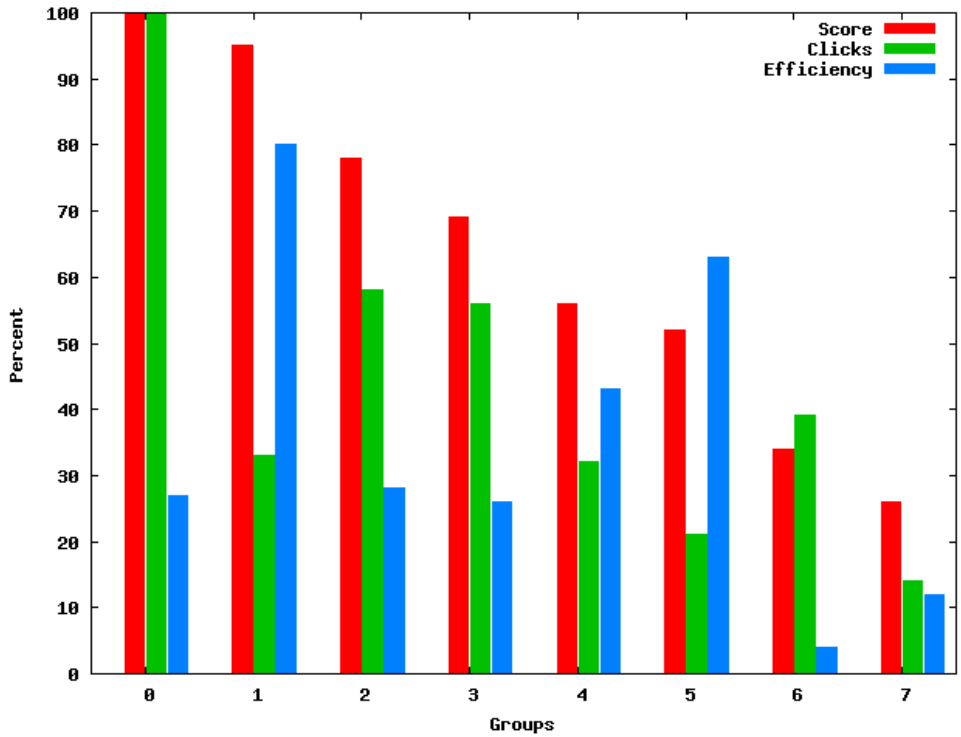


- 775 recorded clicks
- Map is the dominating click origin, with 49.5%, then comes TOC (40%), and the timeline (9.5%)

Clicking efficiency

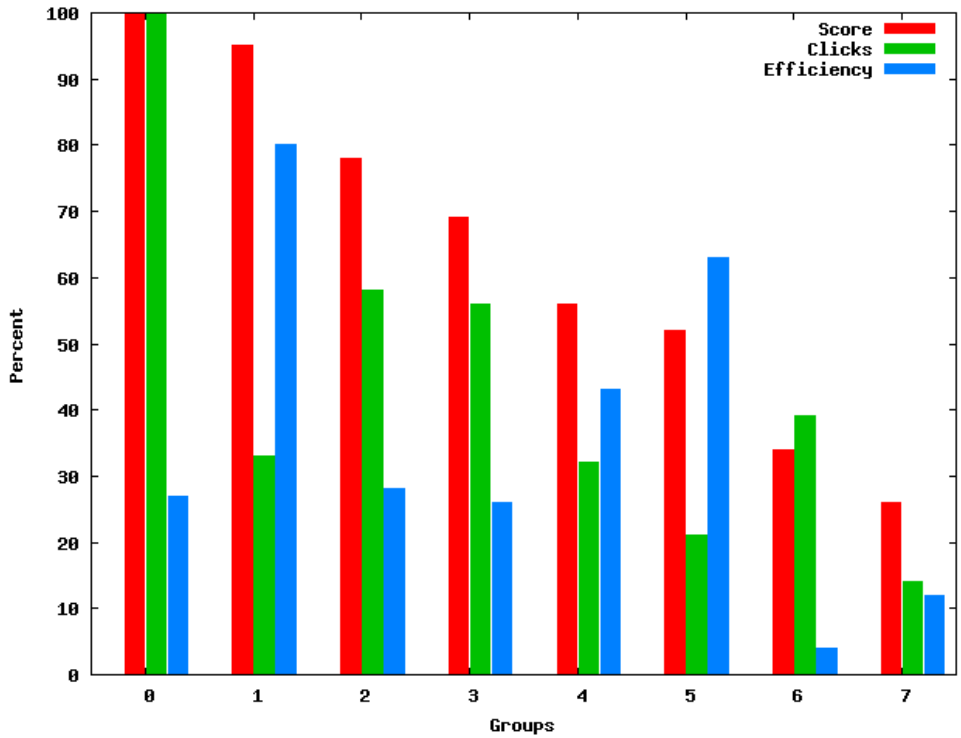
- We needed a way to characterize the *browsing behavior*
- Introduced *clicking efficiency* as a ratio between the total number of required clicks (in worst case), related to score, and the performed clicks
- No extra clicks yields 100% efficiency

Scores, click rates and efficiency



By plotting efficiency, achieved scores, and number of clicks (all as percentages), we notice a large variation in number of clicks (from 32 to 217) and efficiency (from 26% to 100%).

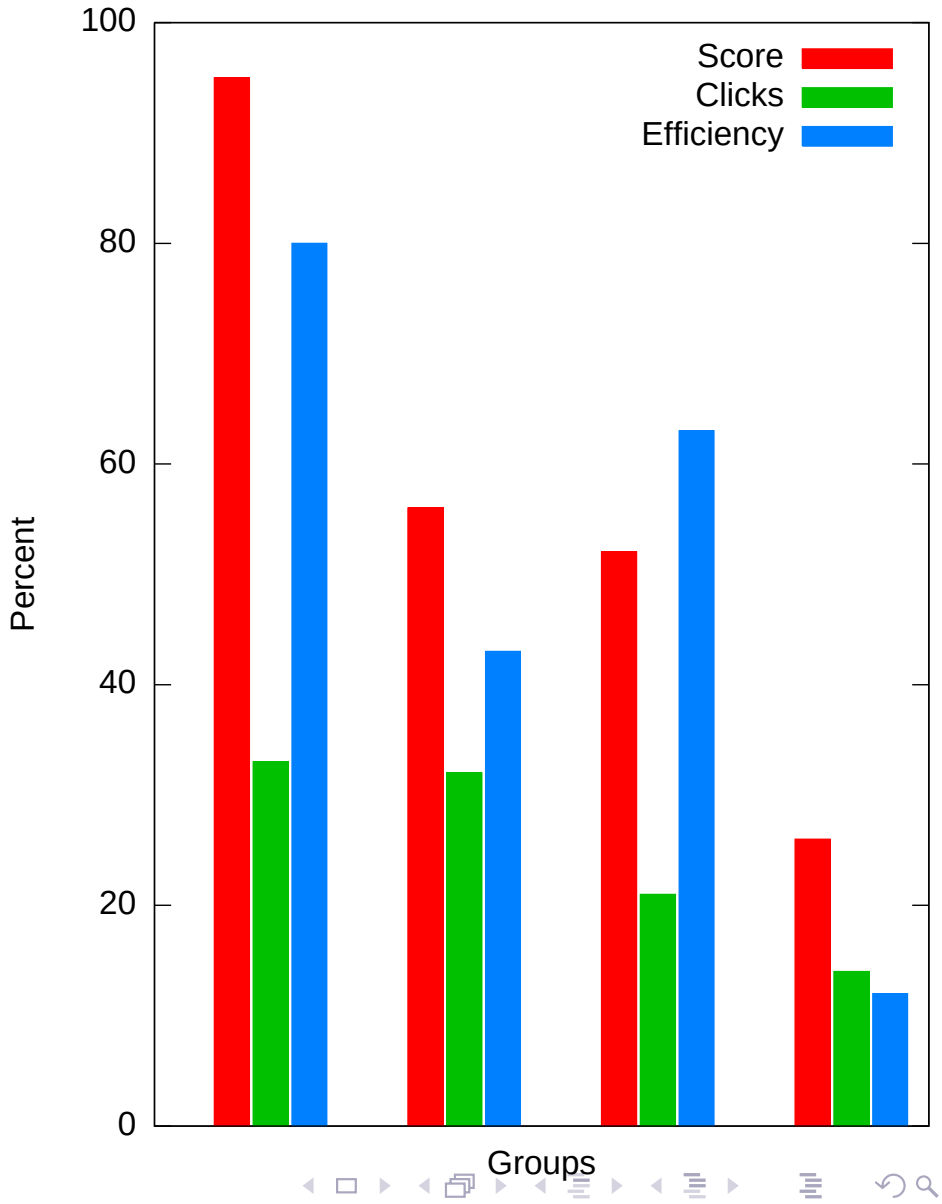
Scores, click rates and efficiency



The two groups with best scores, exhibit radically different behavior. One group has many clicks and, thus, low efficiency, opposed to the other, which has been more restrictive in their clicking.

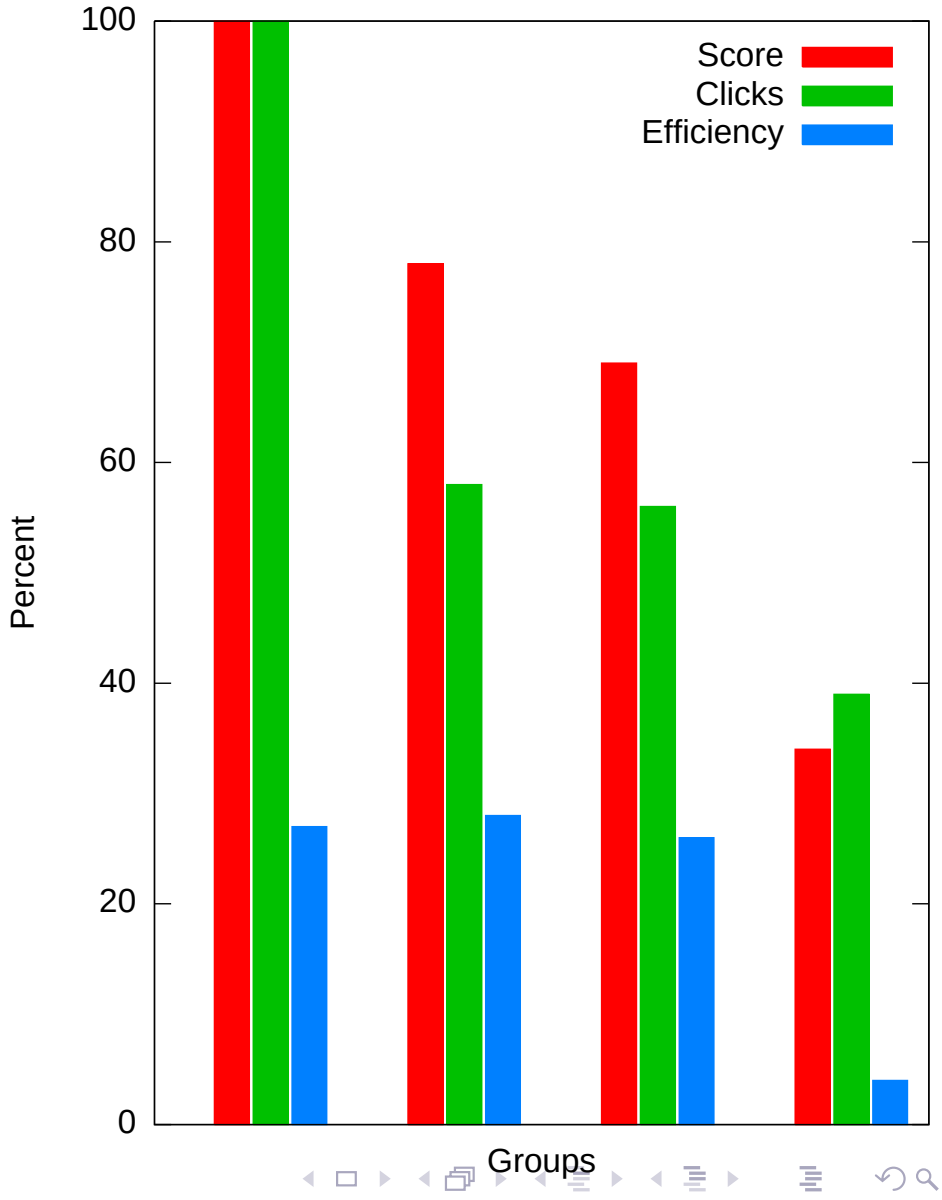
Scores, click rates and efficiency: Convergers

- High level of efficiency, few clicks
- Scores: As expected by the teacher

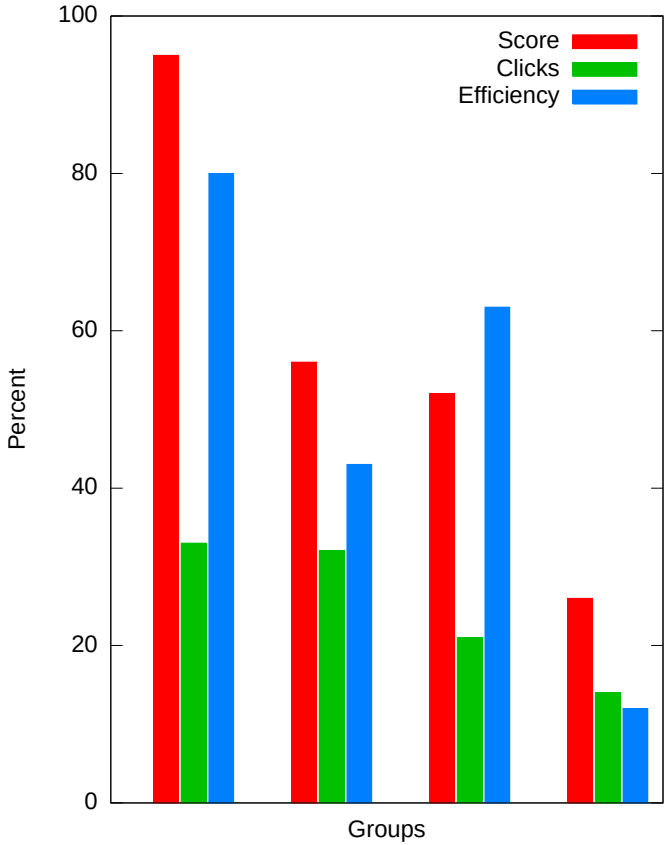


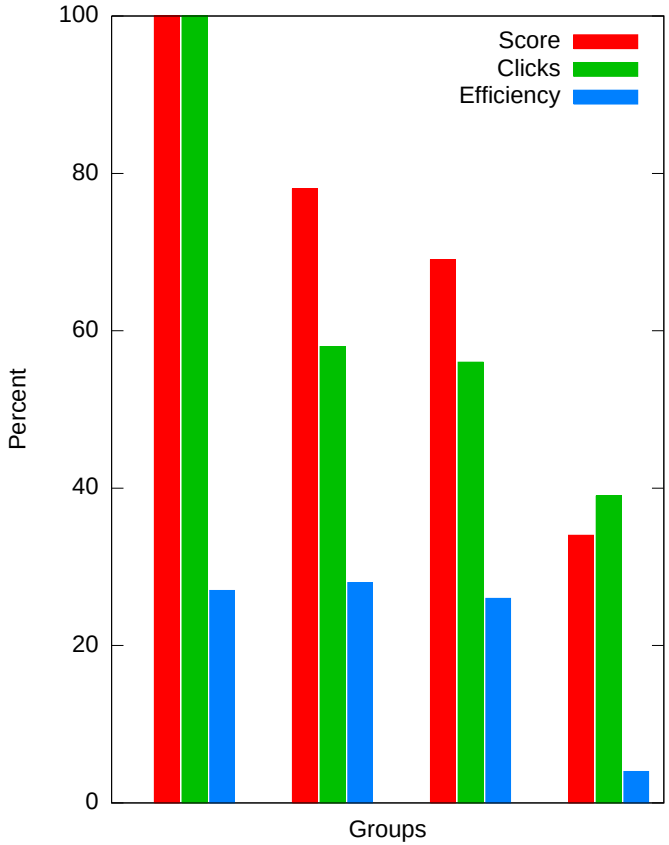
Scores, click rates and efficiency: Divergers

- Low level of efficiency, many clicks
- Surprisingly: The average score is higher among the *Divergers* than the *Convergers* (70.7% against 57.6%)
- The teacher anticipated significantly lower scores for these teams



Scores, click rates and efficiency: Convergers and Divergers





Is this indicating that Storix is an educational tool that in particular supports the *Divergers*, a traditionally “weak” group?

Research limitations

- Small scale pilot study; questionable validity
- Using assignment score as the (only) indication of learning outcome; naïve approach
- Kolb's model of learning styles is developed for college/university students; rarely applied to primary-school pupils
- Used the teacher to categorize the teams according to learning styles; formal methods would yield more valid characterizations

Conclusions

- We have demonstrated that the 7^{th} graders understand, accept and enjoy spatiotemporal storybrowsing
- The pupils preferred the map as the main navigation tool, secondly the table of contents
- Using Storix as a learning tool, the *converger* type pupils performed as expected
- *Divergers* performed far better than expected
- Is Storix a “one size fits all” concept? Further research needed!

Questions?

STORIX demo available on
`http://asia.hiof.no/storix`

...and as free and open source from
`http://storix.sourceforge.net`

...and there is more to read in Øyvind's master thesis [Håkestad, 07]

Thank you for your attention!

References

- M. Bal.
  Narratology: Introduction to the Theory of Narrative.
  University of Toronto Press, 1997.
- R. Eccles, T. Kapler, R. Harper, and W. Wright.
  Stories in GeoTime.
  Information Visualization, 7(1):3–17, 2008.
- Ø. Håkestad.
  Storix: Embedding Digital Stories in Time and Space.
  Master's thesis, Østfold University College, Halden, Norway, 2007.
- D.A. Kolb.
  Experiential learning: experience as the source of learning and development.
  Englewood Cliffs, NJ: Prentice-Hall, 1984.
- B. Lamb.
  Dr. Mashup or, Why Educators Should Learn to Stop Worrying and Love the Remix.
  EDUCAUSE Review, 42(4):13–24, 2007.