MANCHESTER 1824

The University of Manchester

presentation L@L PGR Seminar

Can computers understand time?

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CDT CS Centre for Doctoral Training in Computer Science

Leeds, 01/05/2014

can computers understand time?

- what does it mean?
- why is it challenging?
- what possibilities will it unlock?
- what is there for linguists?

perspectives

- computer science
- information extraction
- computational linguistics
- text mining
- machine learning

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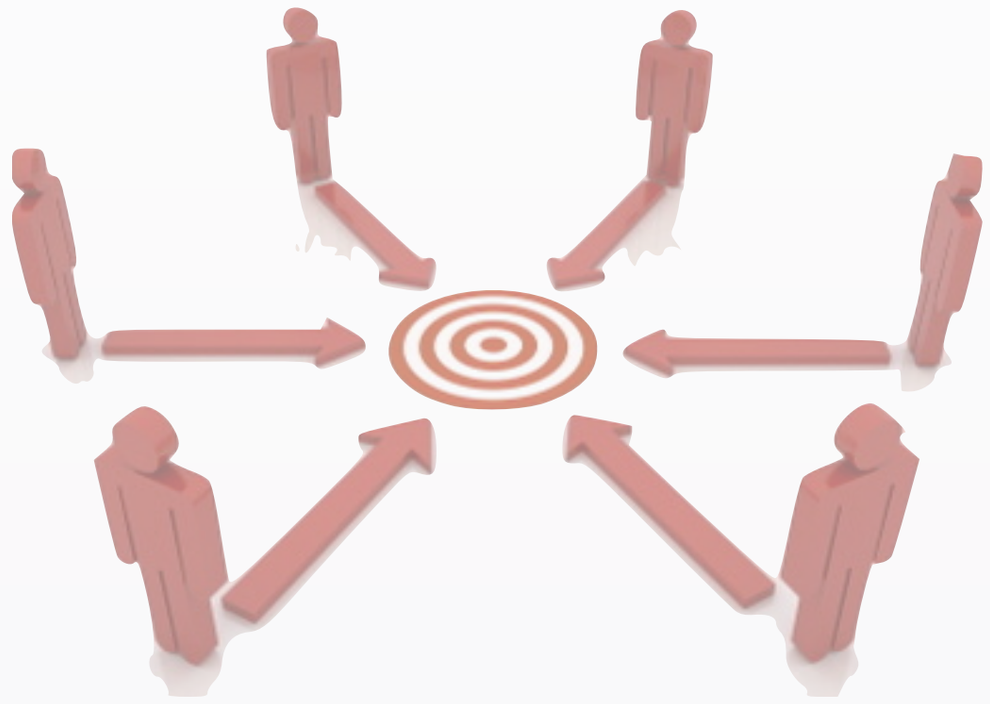
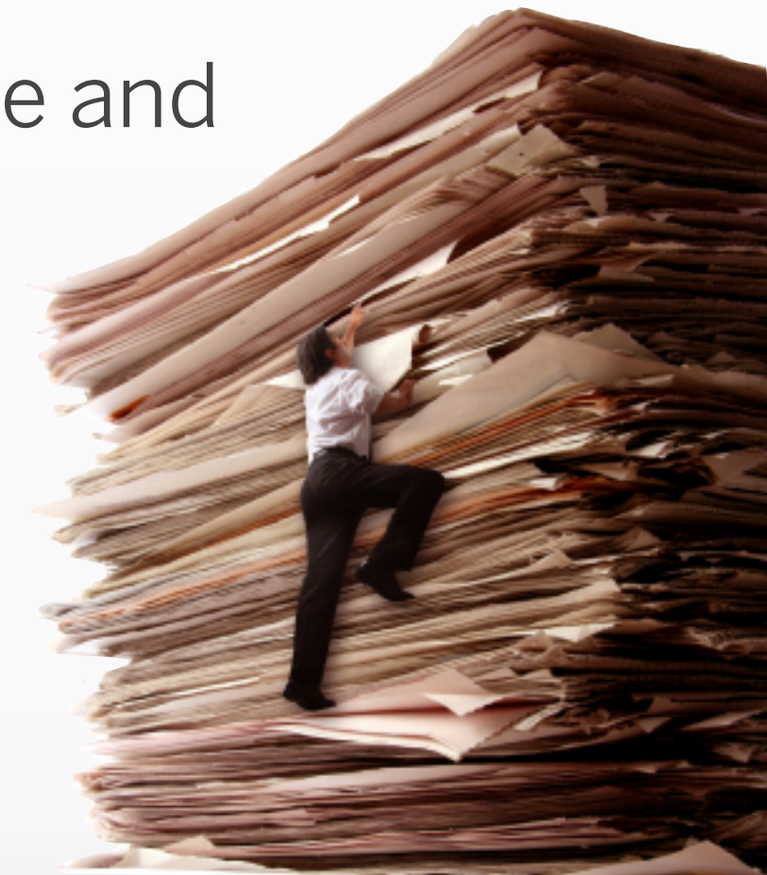


what does it mean?

Temporal aspects of events provide a natural mechanism for organising information

- source: written texts
- goal: identify, interpret, communicate and reason about events
- **easy** for people
- **hard** for machines



linguistic key concepts

- events: phrases denoting eventuality and states
  - inflected verbs and nouns: spoken, deliver, will be published
- temporal expressions: phrases denoting a temporal entity such as an interval or a time point
  - 01/05/2014, March 15, the next week, Saturday, at that time, yesterday, 5 o'clock, 3 days, every 4 hours
- links: temporal relation between two phrases
  - BEFORE, AFTER, INCLUDES, ENDS, DURING, BEGINS

Source: ISO-TimeML

let's try!

- On 28th Feb. 2010, Deutsche Bank released a note saying that China's current economic policies would result in an enormous surge in coal consumption over the next decade.
- In 1978, Steve Furber was appointed the Rolls-Royce Research Fellow in Aerodynamics at Emmanuel College, Cambridge and was awarded a PhD two years later on the fluid dynamics of the Weis-Fogh principle.

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temporal expressions

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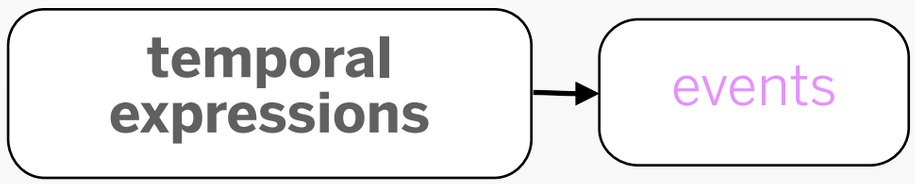

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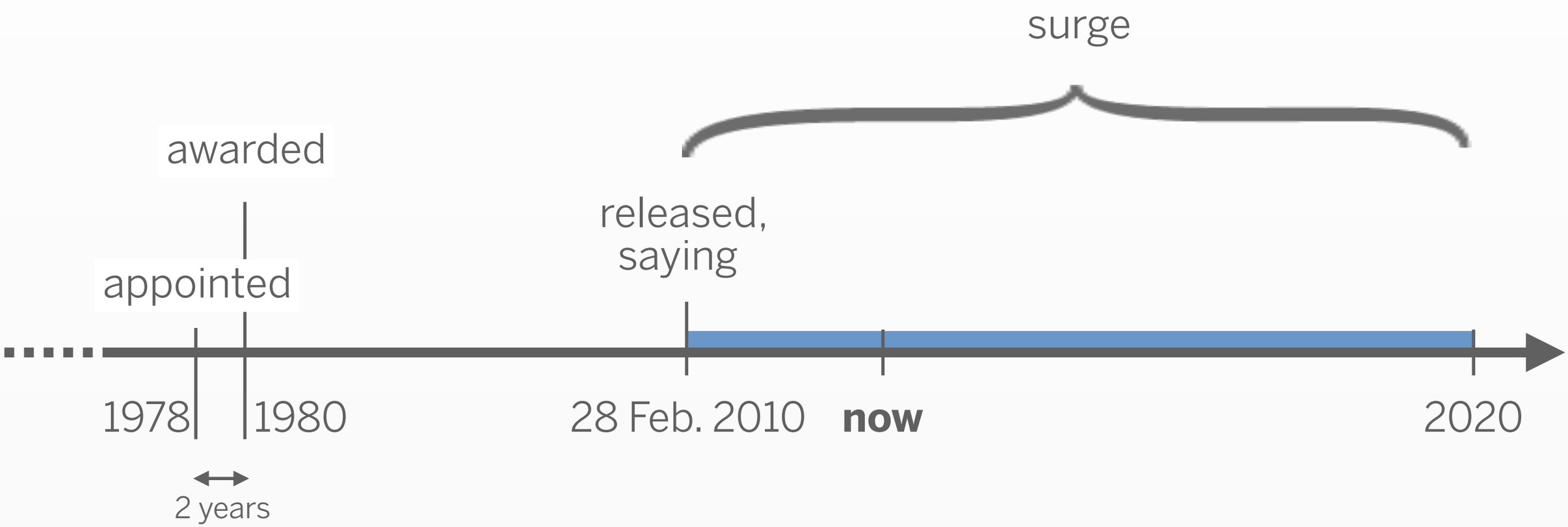
temporal expressions → events → link them

visual representation



why is it challenging?

1. Matt exercised during his lunch break.
2. He stretched, lifted weights, and ran.
3. He showered, got dressed and returned work.

Source: Temporal Information Extraction and Shallow Temporal Reasoning, D. Roth et al. 2012

linguistic knowledge

1. Matt exercised$_{(E)}$ during his lunch break$_{(E)}$.
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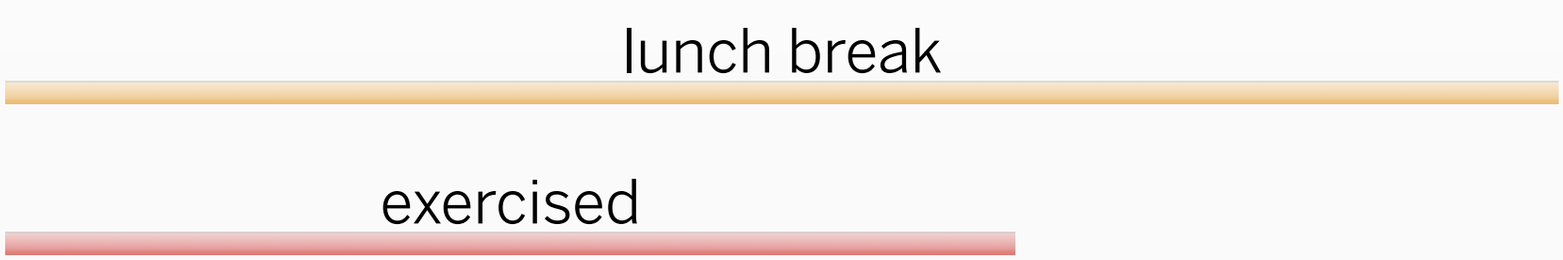

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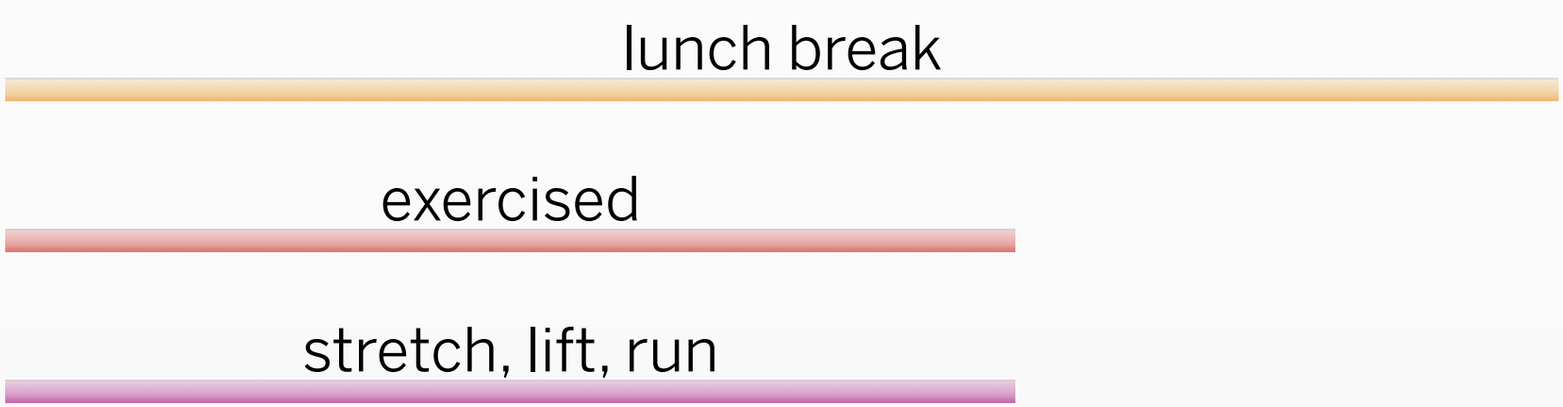

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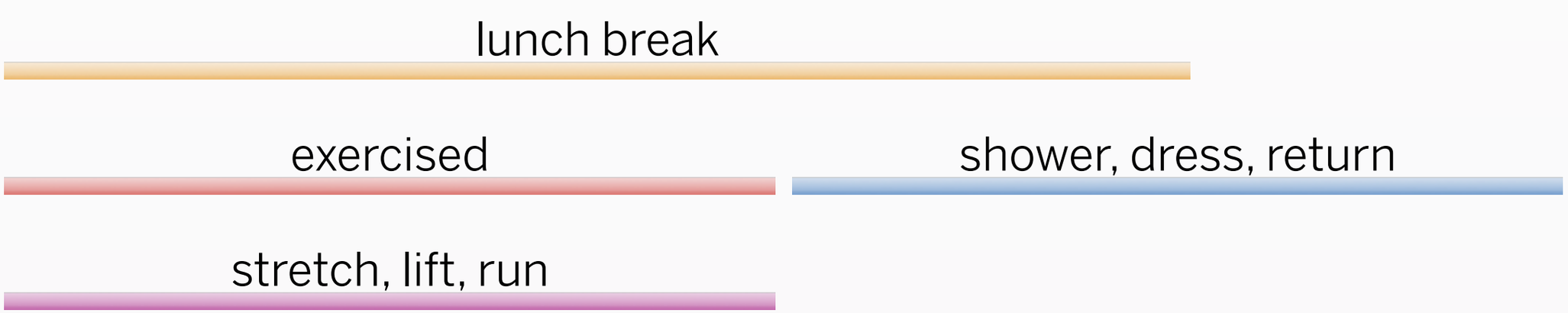

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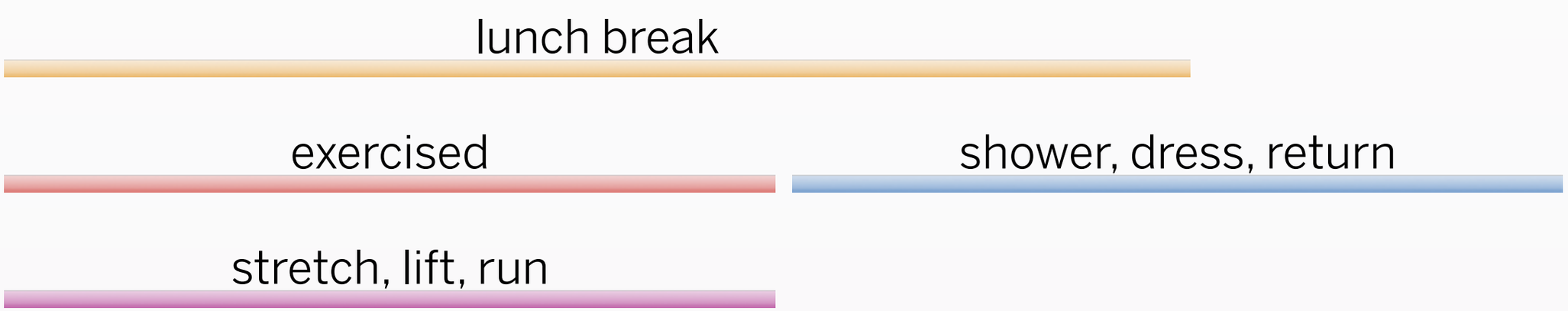

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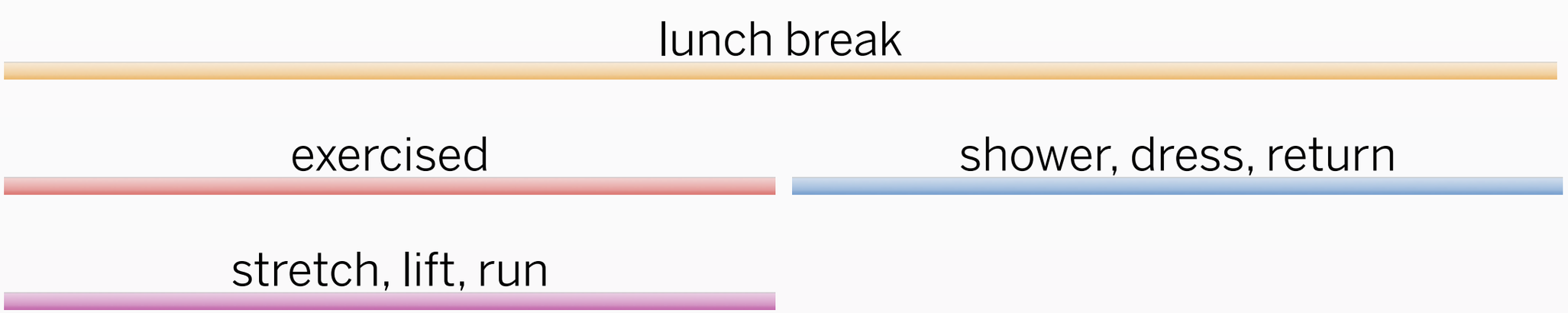

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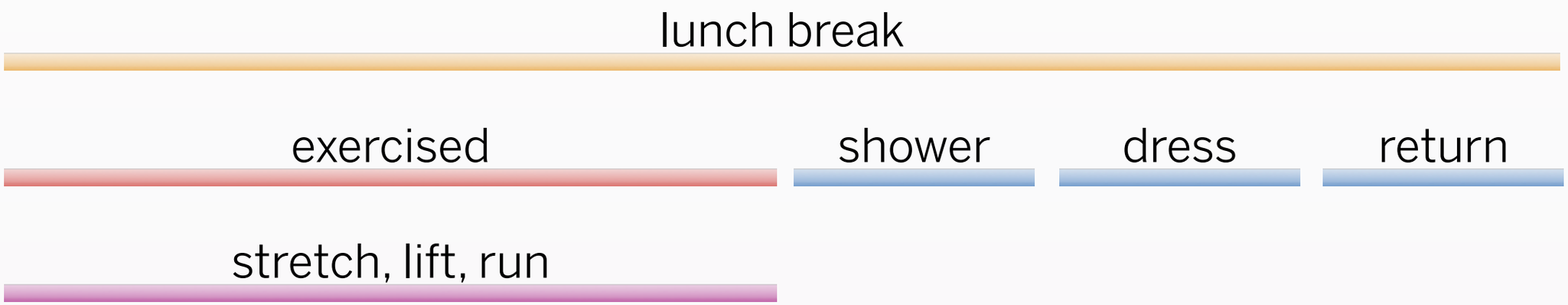

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domain knowledge

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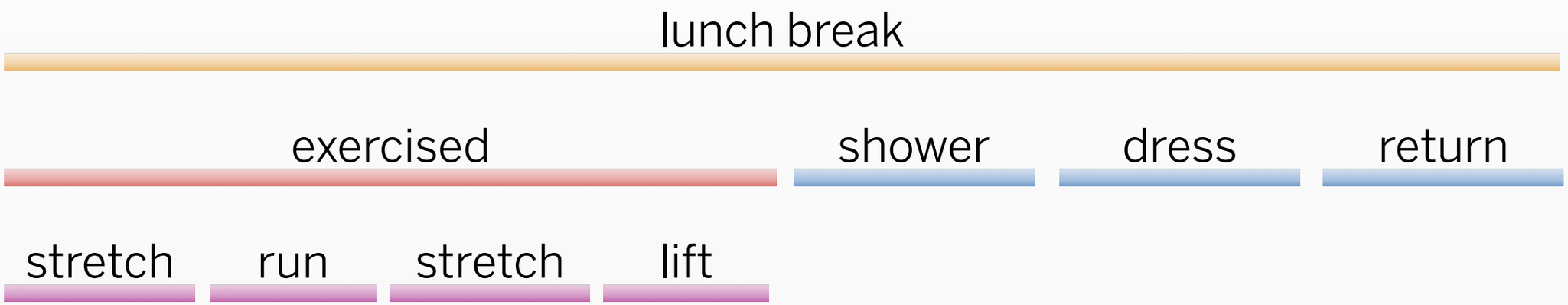

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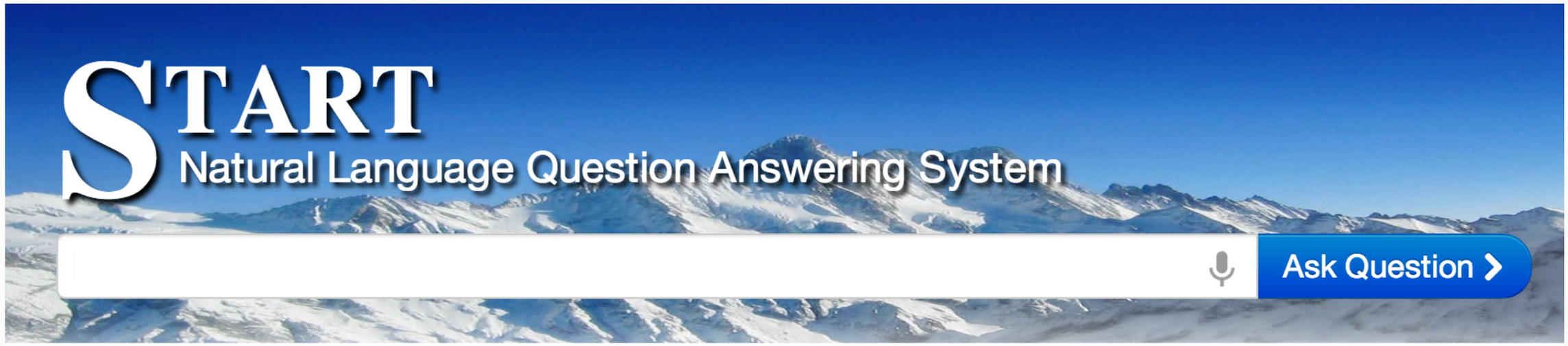
what possibilities will it unlock?



===> How many computers did Galileo Galilei use for his research?

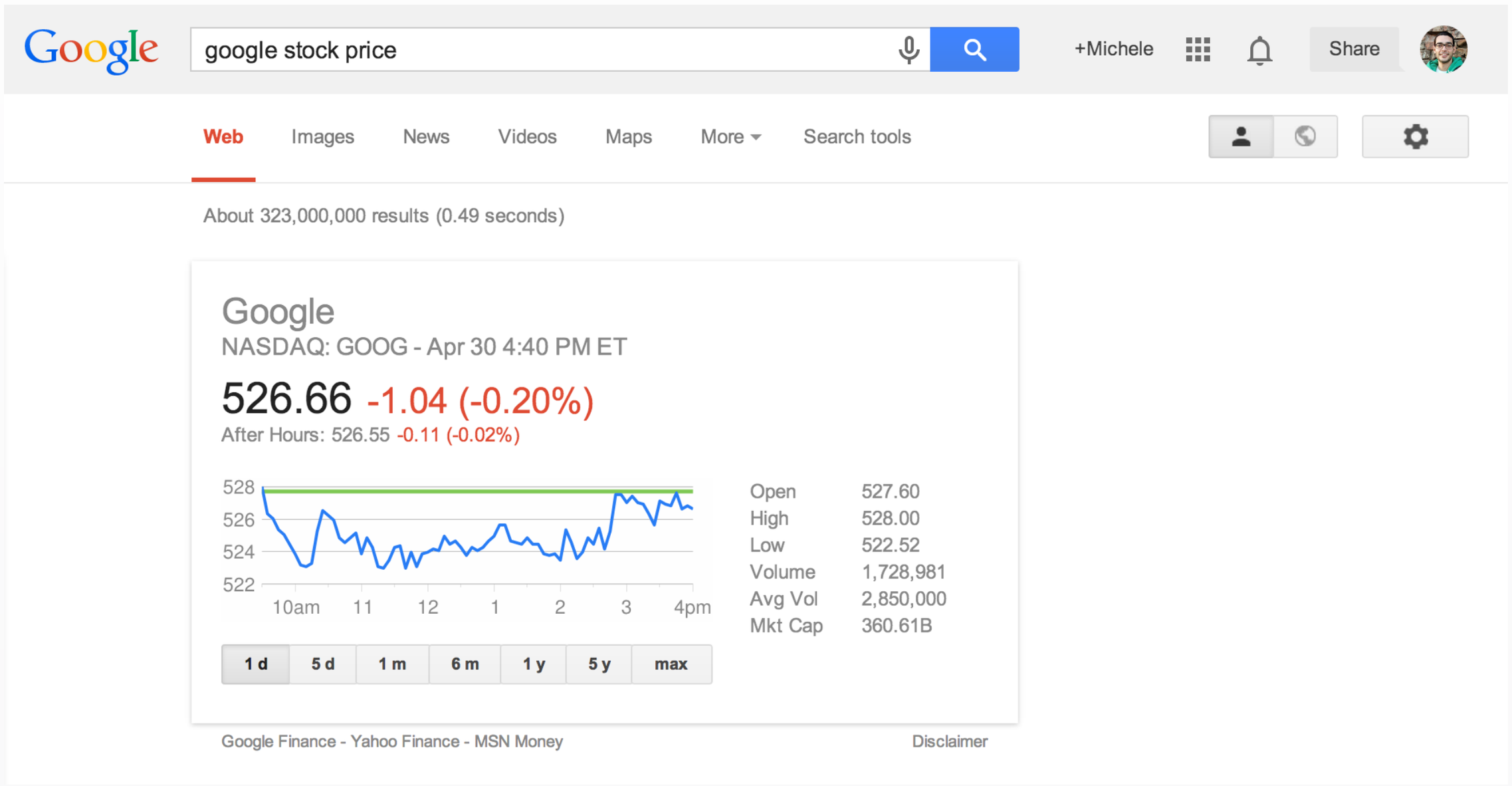
I don't know.

===> Did Beethoven live more than Galileo?

Unfortunately, I don't know whether Beethoven lived more than Galileo.

Source: http://start.csail.mit.edu/answer.php?query=

better search results



Source: https://www.google.it/search?q=google+stock+price

events in emails

Gmail ▾ | Move to Inbox | More | It

COMPOSE

Inbox
Starred
Important
Sent Mail
Drafts
Spam (1)
Trash
Circles

alla longara
CS-GN-TEAM
Da incorniciare
Scholar (1)
social & adv
To print
Less ▲

Chats
All Mail

Categories
CFP

techniques, notably deep parsing.

WORKSHOP PROGRAMME

Saturday, April 26, 2014

8:45–9:00 Opening Remarks

09:00-10:00 Oral Session 1: Detection and Extraction of MWEs

9:00–9:30 Breaking Bad: Extraction of Verb-Particle Constructions from a Parallel Subtitles Corpus
Aaron Smith

CALL FOR PARTICIPATION

Thu, May 1, 2014

9:30am

Add to Calendar

Thu, May 1, 2014

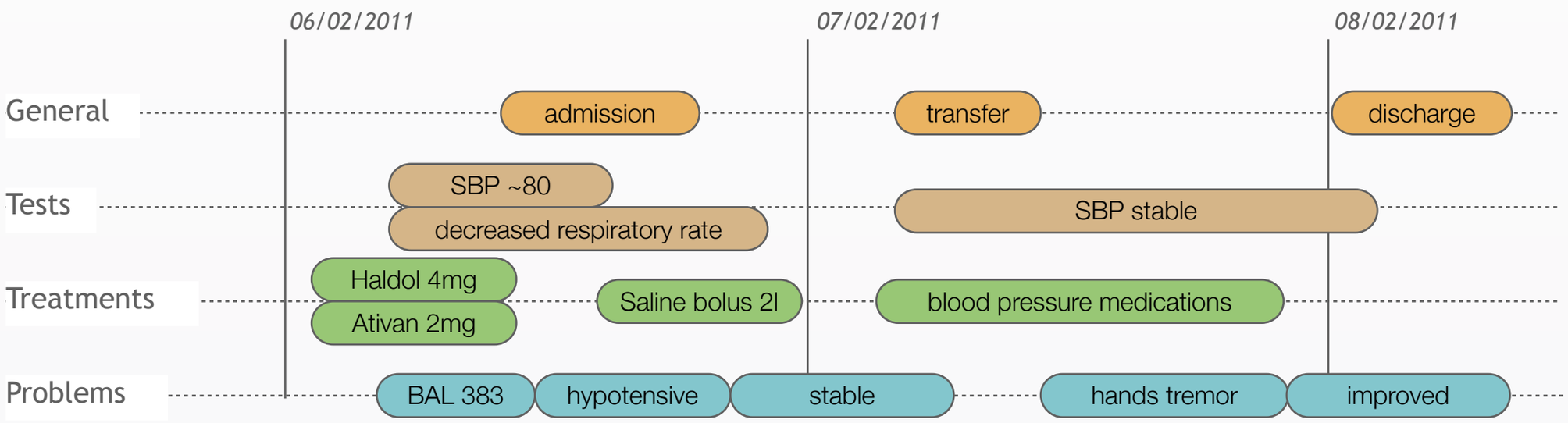
9:30am
CALL FOR PARTICIPATION…

No events.

Source: GMail

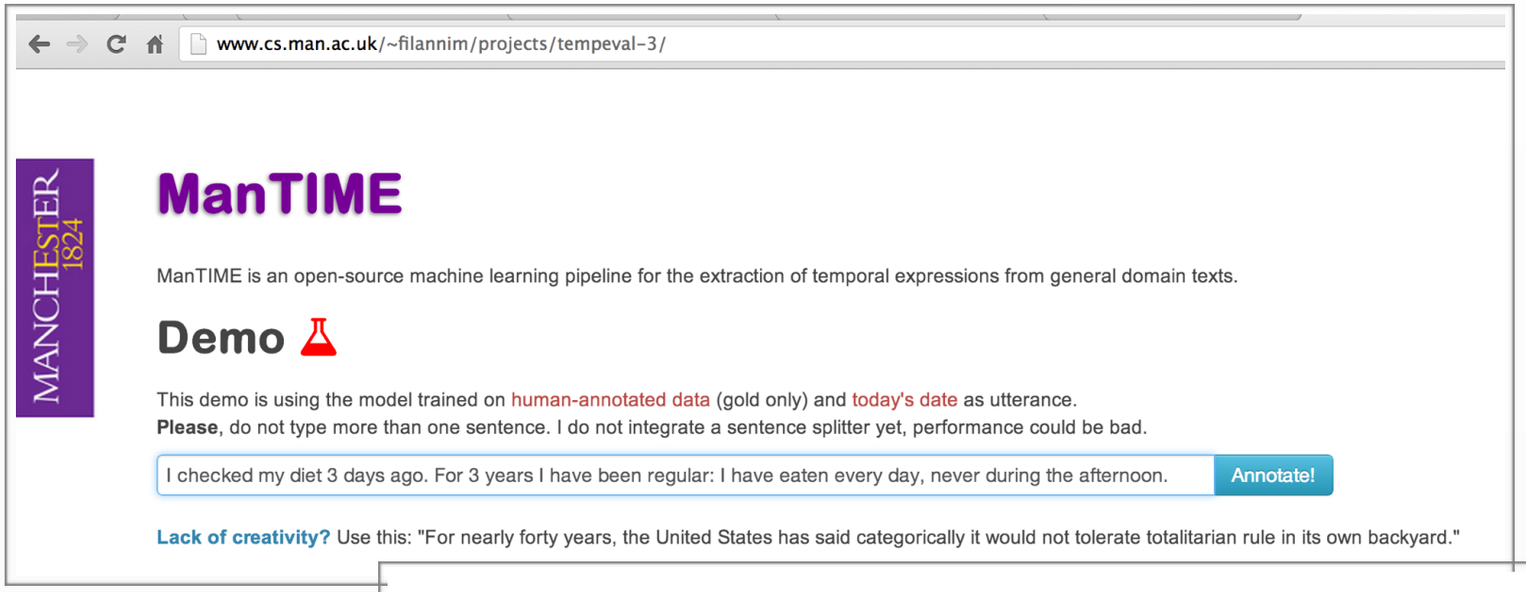
clinical timeline extraction

ADMISSION DATE: 2011-02-06;
DISCHARGE DATE: 2011-02-08;
HISTORY OF PRESENT ILLNESS: Mr. Pohl is a 53 - year-old male with history of alcohol use and hypertension. Blood alcohol level was 383. Agitated in emergency room requiring 4 leather restraints, received 5 mg of Haldol, 2 mg of Ativan. He became hypotensive in the emergency room with a systolic blood pressure in the 80 's and had decreased respiratory rate. He received a normal saline bolus of 2 litres of good blood pressure response. The patient was then admitted to the medical Intensive Care Unit for observation and then transferred to our service on medicine when the blood pressures remained stable overnight...



Source: i2b2/2012 Clinal NLP training data

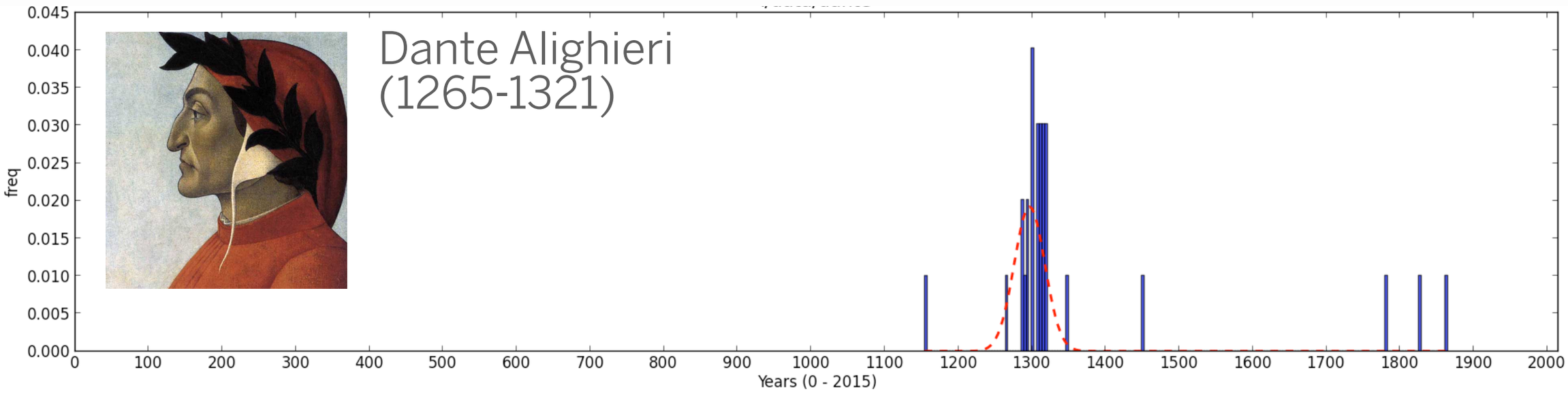
what is there for linguists?



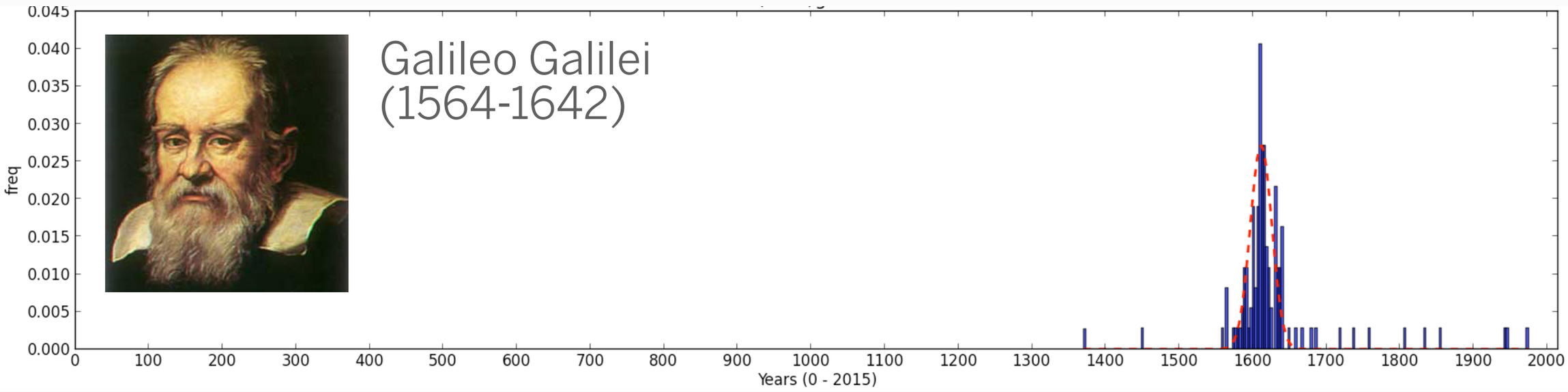
URL: http://www.cs.man.ac.uk/~filannim/mantime.html

concept's temporal footprint

Dante Alighieri
(1265-1321)



Galileo Galilei
(1564-1642)



Note: Online DEMO soon available

open problems

- Are TE, events and links enough? how to spot them?
  - prepositions, surrounding words, digits, temporal dictionary, verbs, noun phrases
- “I’ve played Tennis for 10 years” vs. “I’ve played Tennis for 4 hours.”
- How these systems can automatically adapt to different languages?
- statistics != linguistics

TE = Temporal expressions

Thank you.

QUESTIONS

Contact:
filannim@cs.man.ac.uk