Time Tracks and Time Segments. Rethinking the Way to Look at Texts

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Our perception of time

• She remembered the words that sometimes, at the time of adolescence, her mother told her. "You are a person apprehended, right?..."
Our perception of time
Our perception of time

• In the kitchen, waiting for the water to boil, Margaret wondered how was it that she jumped so naturally to embrace Adam. She could not realize what had made her feel so happy to see him again.

Tash Aw: Map of the invisible world
Our perception of time

- Margaret feels happy
- Margaret embraces Adam
- Margaret waits for the water to boil
- Margaret wonders...
- Margaret cannot realise...

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Goals

• A computational representation of temporal phenomena occurring in literary texts, preparing thus investigation tools that would make possible to tackle these phenomena by automatic analysis

• There were readers perceive:
  – changes of the current direction of time,
  – flashbacks and flashforwards,
  – temporal ruptures,
  – perspectives of different narrators on the same story
In this talk

• Time can be better visualised as threads that interlace and separate,
  – much like railways do in complex rail yards: time tracks
• Propose an XML notation for these representations
• Show a few examples that put in evidence different temporal manifestations
  – commute, rupture, join and split points
• Make a preliminary evaluation of the annotations on a small corpus
• Freely think further. No conclusions!
Our work is framed in...


• Temporal Reasoning (and temporal logic: Allen, etc.)
• Annotation conventions/standards to cope with time as mentioned in language and text
• Much interest:
  – information extraction
  – question answering
  – textual entailment
Related work

– A notation: TimeML
  – TIMEX3: mark up explicit temporal expressions (times, dates, durations, etc.)
  – SIGNAL annotate function words that indicate how temporal objects are to be related to each other (e.g. on, during, when, if, etc.)
  – TLINK - Temporal Links: the temporal relationship holding between events or between an event and a time
  – SLINK - Subordination Link: relations between two events, or an event and a signal
  – ALINK - Aspectual Link: relationship between an aspectual event and its argument event
  – EVENT


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Related work

– A system (the TARSQI Toolkit) that recognises:
  • temporal expressions (TimeEx)
  • events
  • relations between them

Verhagen & Pustejovsky: Temporal Processing with the TARSQI Toolkit, Coling 2008
Related work

– Narrative Containers: assumed windows provide left and right boundaries for when unanchored events most likely occurred; size parameterized by Document Creation Time (DCT) and the periodicity of the source

– Narrative Scope: the timespan between the earliest and latest events described in the document

– Narrative Time: the current temporal anchor for events in a document; temporal focus shifts as the reader moves through the document

=> the manner in which events are linked (related) to the DCT in TimeML

Related work

• The model of Narrative Container and its relations wrt to:
  – Channel: is the document written or spoken?
  – Production circumstances: how was the document distributed? broadcast, newswire, daily publication
  – Style: what format was used to present the information?
  – Presence of a temporal anchor: whether an article contained a Narrative Time in the first sentence of the document

However...

• Fiction never mentioned in these studies
  – most interest attached to process newswires and broadcasted information

• Less or no attention given to the link between events and characters involved
  – and there is more than the mere role of agent in an event:

  *John met Ana when exiting the Opera House. He said: Amazing voices!*
We are interested in connected sequences of events

• In historical studies, dramaturgy and narratology
  – 1906: *story line*:
    Amer. Physician Mar. 86/1: *He had to confess his inability to do the story-line justice.*
  – 1907: *time line* – A line used to illustrate or represent a chronological sequence of events; a chronology; a chronological sequence
    J. W. Adamson Pract. of Instr. II. iv. 275: A *time line for English history... can be made with great advantage when the class is taking its first connected course in English history.*
We are interested in connected sequences of events

• In NLP
  – *TimeLine*: a representation of events which are chronologically ordered, in general specific for an entity (a character or participant in an action, a geographical place or region)
  

  – *StoryLine*: groups of interacting TimeLines, or mergers of two or more TimeLines where the same characters or entities are taking part in the action. A kind of text structure which is not related to the flow of time.

We are interested in connected sequences of events

• In NLP

  – *timeline* (or *fabula*): a set of event instances ordered in time (anchored to time expressions or relative to each other) and a set of bridging relations between events with explanatory and predictive value (rising action, climax and falling action)

  – *storyline*: the timeline made of those events which have the highest connectivity score

⇒ detect storyline in massive streams of news

⇒ not concerned with deciphering the temporal structure of texts

*Vossen, Caselli and Kontzopoulou (2015). Storylines for structuring massive streams of news. In ACL-IJCNLP*
Motivation and goal

• Large texts are different then news
  – news: sequences of events, opinions, commentaries
  – novels: events are seldom presented in non-sequential order, same events are interpreted from different perspectives

• Characters participate in events

• Each has her/his own trajectory/destiny/evolution

• Although characters’ trajectories intersect in time, one would like to distinguish/separate them
The *time yard* model

- A Time Yard (TY) is a representation (resembling a diagram) of the characters’ destinies (a too... precious term) in a text, unfolded on the story time axis
- A TY is made of Time Tracks (TTs)
- A TT is made of Time Segments (TSs)
- A book is a sequence of Time Segments
Time Tracks

• A TT displays the story development of one character or a stable group of characters over a period of story time.
  – TTs are deciphered by the reader as having a unity of characters, action and development
  – One TT can be narrated by one or more relators
  – TTs are not necessarily characterised by a unity of place
Border points of TTs

• Time tracks can be bordered by:
  – *start points* – where they start,
  – *end points* – where they finish,
  – *join points* – in which two different time tracks unify,
  – *split points* – where one time track splits into two separate time tracks.
Time Segments

• A TS groups a sequence of events of one character or a stable group of characters over a period of story time, that is uninterruptedlly told in a span of text.
  – one TS is necessarily told in a continuous span of text
  – in a TS, the story time evolves linearly
  – one TS can be narrated by only one relator
Border points in TSs

• If inner to TTs, TSs can be bordered by:
  – *rupture points* – where the story commutes from one time track onto a different one
  – *commute points* – in which, although the story goes on, it is said from a different perspective, by a different storyteller; or it moves forth or back on the same TT.

• If at the extreme of TTs, TSs can also be bordered by:
  – *start or split points* – on the left side
  – *join or stop points* – on the right side.

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Margaret in the kitchen...

• TS1: [In the kitchen, waiting for the water to boil, Margaret wondered how was it that]
• TS2: [she jumped so naturally to embrace Adam.]
• TS3: [She could not realize what had made her]
• TS4: [feel so happy to see him again...]”
TTs and TSs in Margaret&Adam’s episode

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Margaret and her mother...

• TS1: [She remembered the words]
• TS2: [that sometimes, at the time of adolescence, her mother told her. "You are a person apprehended, right?...]

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TTs and TSs in Margaret and her mother's episode
Split points

- TS1: [Up to climb into the truck and disappear after the tarpaulin fall down,]
- TS2: [he followed them slowly, with his clumsy gait.]

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Join points

• TS1: [It was only when she came to the doorway that she realized]
• TS2: [someone was there, lying on the front steps. He was a boy, a teenager, almost crouched in the womb.]

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Tash Aw’s “Map of the invisible world”
bird’s eye time yard
Reading the TY diagrams

• Misses/discontinuities
  ⇒ horizontal axis in a TY represents the story-time
  ⇒ not compulsory that a text includes a complete description of an interval
  ⇒ segments may not fill contiguously a certain TT
  ⇒ discontinuities: pauses, misses (interrupted lines in the figure above)
Reading the TY diagrams

• Tracking characters’ destinies (developments)
  => in bold in the figure: Adam’s trajectory
  => a mere selection operation in the set of TT elements
  => produce focused summaries
Not shown in TY diagrams

- Ambiguous temporal placements: when the exact order of TSs cannot be determined
  => more TSs belong to the same TT
  => but their order is undefined
Not shown in TY diagrams

- Personal interpretations:
  => different TSs are told by different relators

  => the same TS is told by different relators
An XML notation – in addition to those of TimeML

- **Elements marking Time Tracks:**

  `<TT NAME ACTORS ID LEFT-EP RIGHT-EP/>`

  - LEFT-EP: “START” | ID of a SPLIT end-point
  - RIGHT-EP: “STOP” | ID a JOIN end-point

- **Elements marking Time Segments**

  `<TS ID IN-TT TIME TYPE PER>...</TS>`

  - IN-TT: ID of a TT
  - TIME: ID of TIME element
  - TYPE: NARration, REMembers, SUPposition, GENeral knowledge, FICTIONS
  - PERspective: a character (entity)
An XML notation

• Elements marking time constraints
  <TIME ID FROM REL TO/>
  – FROM and TO: IDs of TS
  – REL: BEFORE, IMMEDIATELY-BEFORE, AFTER, IMMEDIATELY-AFTER, SIMULTANEOUSLY, INCLUDES

• Elements marking endpoints
  <ENDPOINT ID TYPE TT1 TT2/>
  – TYPE: “JOIN” or “SPLIT”
  – TT1 and TT2: IDs of the two TTs that either join or split
The corpus

• Few pages from the same novel annotated by a class of master students in CL
  – interested to evidence inter-annotator agreement

• Tash Aw: *Map of the invisible world* (Romanian version) – currently under annotation (by Andreea Macovei)
  – to be used in training a TY parser
Evaluation

• Interested to appreciate interannotator agreement on perceiving TTs and TSs
• 2 small fragments from MotIW
Continuation

• On going annotation of the whole MofI IW novel
• A TY visualiser under construction
• A TY annotator that will work hand in hand with the visualiser
But we, ourselves, live on time yards...

- We live our lives sequentially
  - I lived within my family until the age of 16, then for two years I went in another city to follow a high school, then for 5 years I was a student in Bucharest, and one year before finishing the faculty I was married, then I came to Iași and 4 years later my first daughter was born, and when she was 5 I got divorced, one year later I married again a.s.o.
Our TYs

• My first daughter’s story...
• Our lives meet, then split, then meet again...
• We meet many people during our lives, each having her/his own trajectory

=> like railways...
When I say: *I lived within my family until the age of 16...*

- Actually, *each day I went to school, in the holidays I went to my grandparents house in the countryside, and I went many times to cinema...*
- ... and my parents were not near me all the time.

  => looked at it under the lens, a time segment reveals many more (finer) segments
  => it also depends on the **perspective**...
A time track perspective

• Somebody thinks/believes that somebody else has a certain trajectory

  => courses of events can be seen differently through different perspectives

  => sometimes TTs of a community of people are grossly seen intertwined, just like making a single destiny: collectivities, people living in a country

  => although each has her/his own (developing) TT
A digression

• GENLIAS (www.genlias.nl) – digitisation and transcription of one of the biggest collection of birth, marriage and death certificates in the world: now approx. 15 million certificates on 50 million people => 32 million cert.

• LINKS – connects the names in certificates => traces the trajectory of the population and rebuilds families
Just imagine...

• ... that there is a device that records the TT of each one of us
  => technologically feasible
  => perhaps not very much wanted... (sentiment of BB oppression, leaks, etc.)

• BUT...
  => pages of history can be automatically written, with a proper intelligent summarisation agent
  => one can leave parts of her/his life to the posterity...
An application: MyDiary (ForgetMeNote)

• An Assisted Leaving project: in the benefit of old persons in danger of Alzheimer disease...
  – the Agent “follows” the Master from awaking till going to bed
  – it perceives walkings, drivings, encounters, etc.
  – at the end of the day the agent engages a dialogue with the Master
    • to clarify ambiguous moments
    • to exercise Master’s memory
An application: “Taking the foreign language teacher with me”

- An agent able to teach a tourist the language of the country she/he travels in, in a dynamic, interactive manner.
  - aware of the situation the user happens to be in
  - assists her/him
  - offers linguistic support, adaptable to the progress the user is making in learning the language
    - drilling exercises adapted to the situation,
    - explanations of the reality around her/him by appealing to cultural idiosyncrasies,
    - real time support in conversations, etc.
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