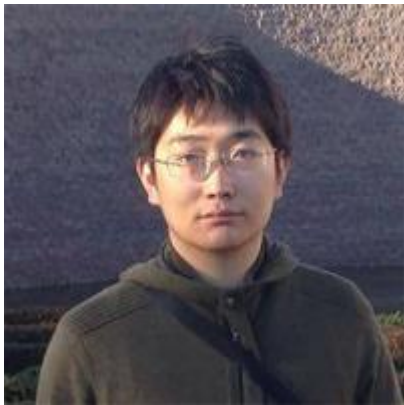
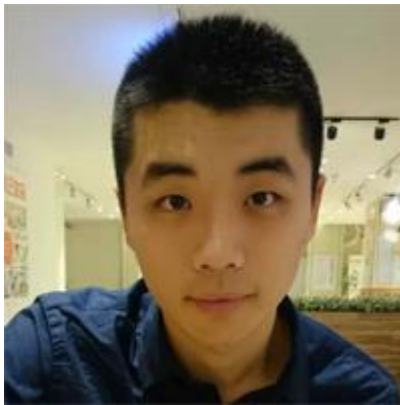




Event-Centric Natural Language Understanding



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Feb 2021

AAAI Tutorials

Event-Centric Natural Language Understanding

- Human Language is used to describe and reason about events.
- We use it to
 - Describe what happened
 - (and would could have happened, or may happen)
 - Reason about Who did what to whom, and why
 - Understand what led to what? What caused what?
 - We describe and hypothesize thoughts about events, feelings, and plans

In the months leading up to the riot, Mr. Lee had **helped organize** a series of pro-Trump car caravans around the country, including one that temporarily **blockaded** a Biden campaign bus in Texas and another that briefly shut down a Hudson River bridge in the New York City suburbs. To help pay for dozens of caravans to meet at the Jan. 6 rally, he had **teamed up** with an online fund-raiser in Tampa, Fla., who secured money from small donors and claimed to pass out tens of thousands of dollars.

Rodgers finished 23-of-36 for 296 yards and two touchdowns. His numbers could've been even better had his receivers not dropped a couple of his passes. One **dropped ball** was a potential score to Allen Lazard. Despite the drop, Lazard made up for it by leading the Packers in receiving. With Davante Adams tied up with Jalen Ramsey, Lazard was able to **snatch** four balls for 96 yards and a touchdown. Adams still had a great game despite Ramsey's coverage, hauling in nine of his 10 targets for 66 yards and a touchdown. The score **frustrated** Ramsey because another defensive back was supposed to pick up Adams, who was in motion.

- We describe events in different levels of abstractions

1. Turkey **forces down** Syrian plane.
2. Damascus sends note to Ankara over Syrian plane.
3. Turkey Escalates Confrontation with Syria.
4. Turkish PM says plane was carrying ammunition for Syria government.
5. Last night Turkish F16s **grounded** a Syrian passenger jet.
6. Russia angry at Turkey about Russian passengers.

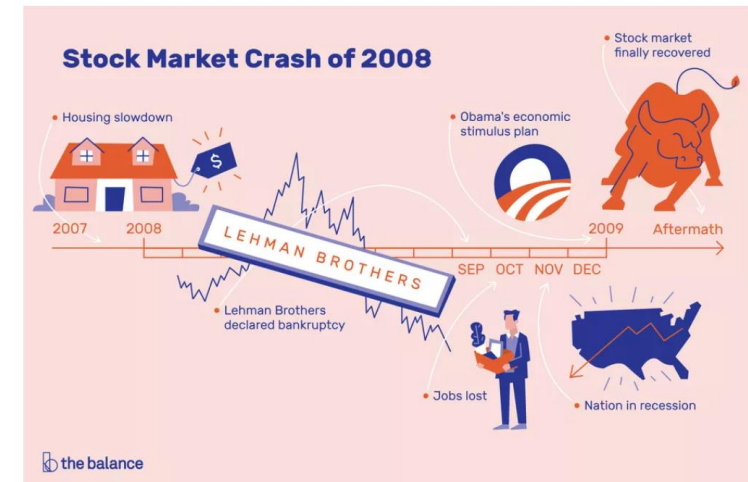
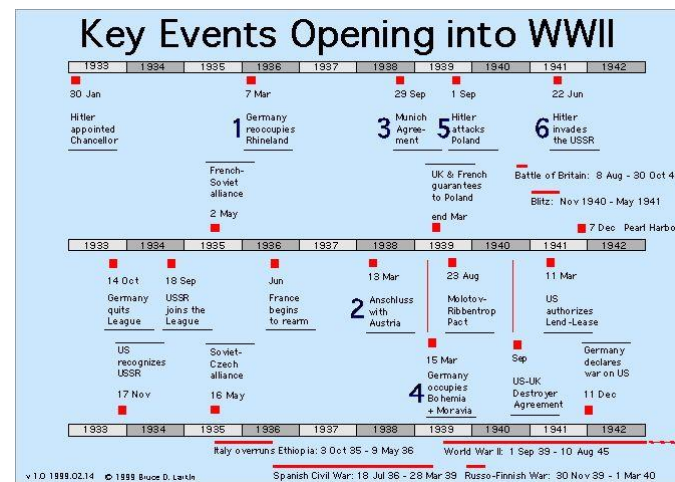


Napoleon Invades Russia

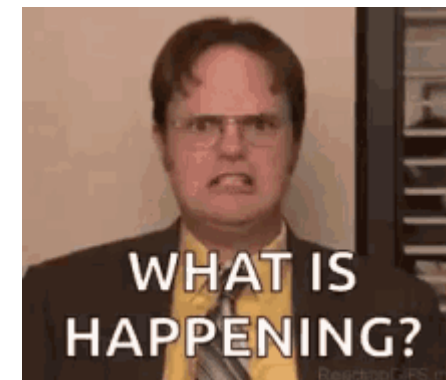
- We reason about events in multiple granularities

- With a range of goals in mind

PREDICTIONS What Will Happen In 2021? Here's What People In 1921 Predicted.



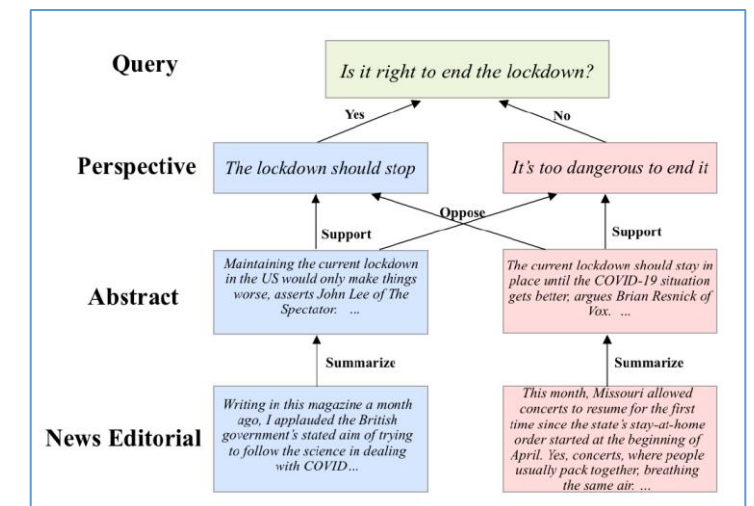
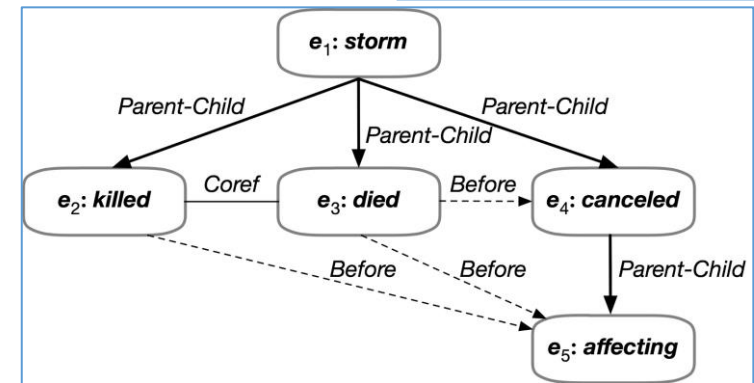
- Most of the work in NLP focuses on understanding “what the text says”
 - We analyze “what’s written here” at the sentence level (mostly)
 - But more and more also at a document level
 - And even, rarely, at a multi-document level
- But with the level of progress in “what the text says”
 - We can now attend to “what is happening”



Understanding “What is Happening”

- Event-Centric Natural Language Understanding and Information Extraction
 - Brings some change in foci and priorities
 - It requires “local” text understanding
 - But necessitates integrating information from multiple documents (and modalities)
 - Information aggregation and consolidation
 - Understanding multiple types of events
 - Understanding relations between events
 - Understanding time and causality
 - Acquiring and using background and commonsense knowledge
 - The ability to generalize from specific, observed, processes
 - The ability to predict – implicit events and possible future events
 - Eventually, it will also require us to identify that there are multiple perspectives
 - ...
- And integrating all these into an understanding of “what is happening”

On Tuesday, there was a typhoon-strength (e_1 :*storm*) in Japan. One man got (e_2 :*killed*) and thousands of people were left stranded. Police said an 81-year-old man (e_3 :*died*) in central Toyama when the wind blew over a shed, trapping him underneath. Later this afternoon, with the agency warning of possible tornadoes, Japan Airlines (e_4 :*cancelled*) 230 domestic flights, (e_5 :*affecting*) 31,600 passengers.

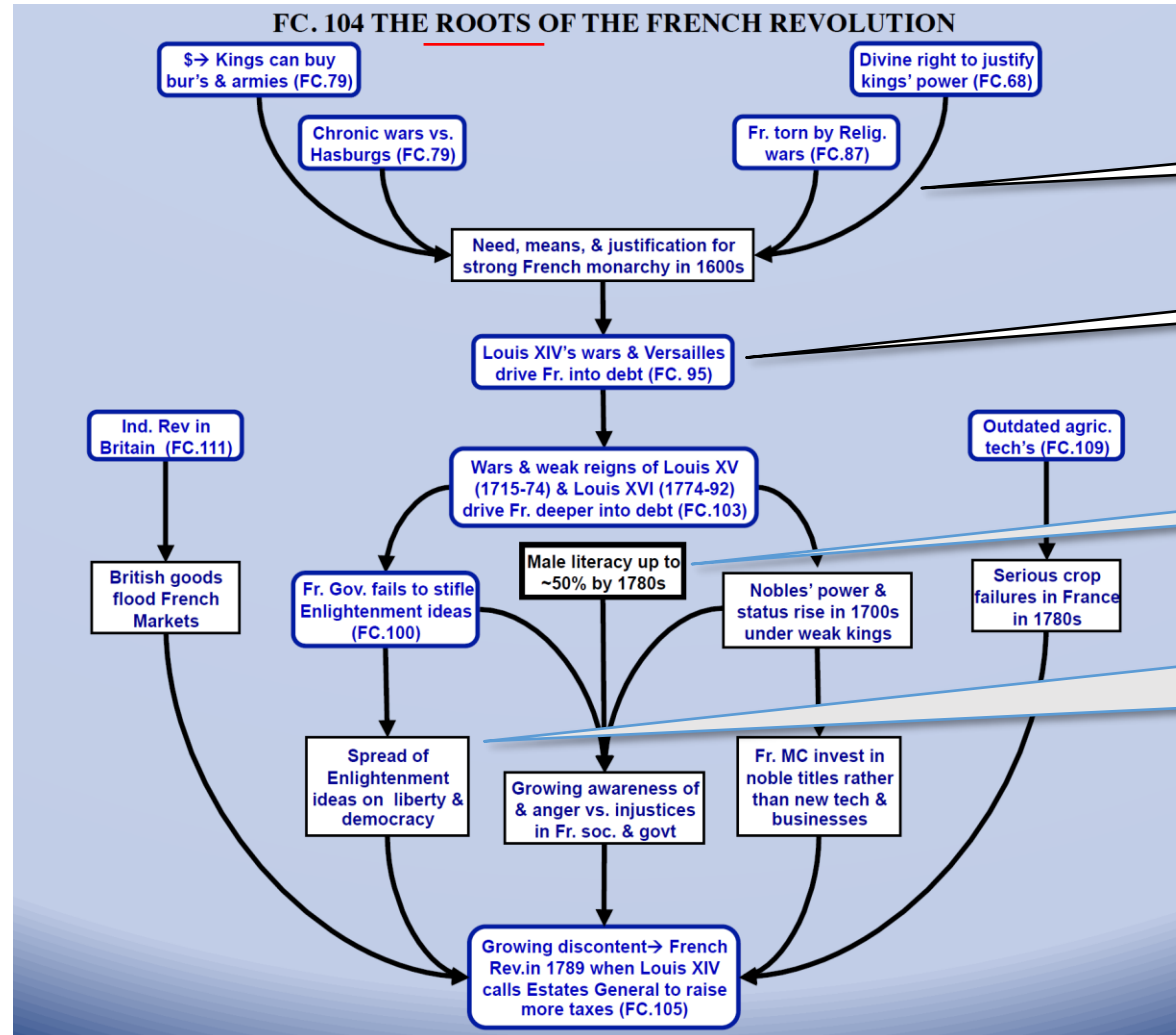


- Ideally, at multiple levels of granularities
 - And accounting for multiple perspectives and interpretations

The history of Democracy

- One way to start is with the French revolution

Credit: The Flow of History, by Chris Butler



Influence

Earlier Flow Charts

Earlier Flow Charts

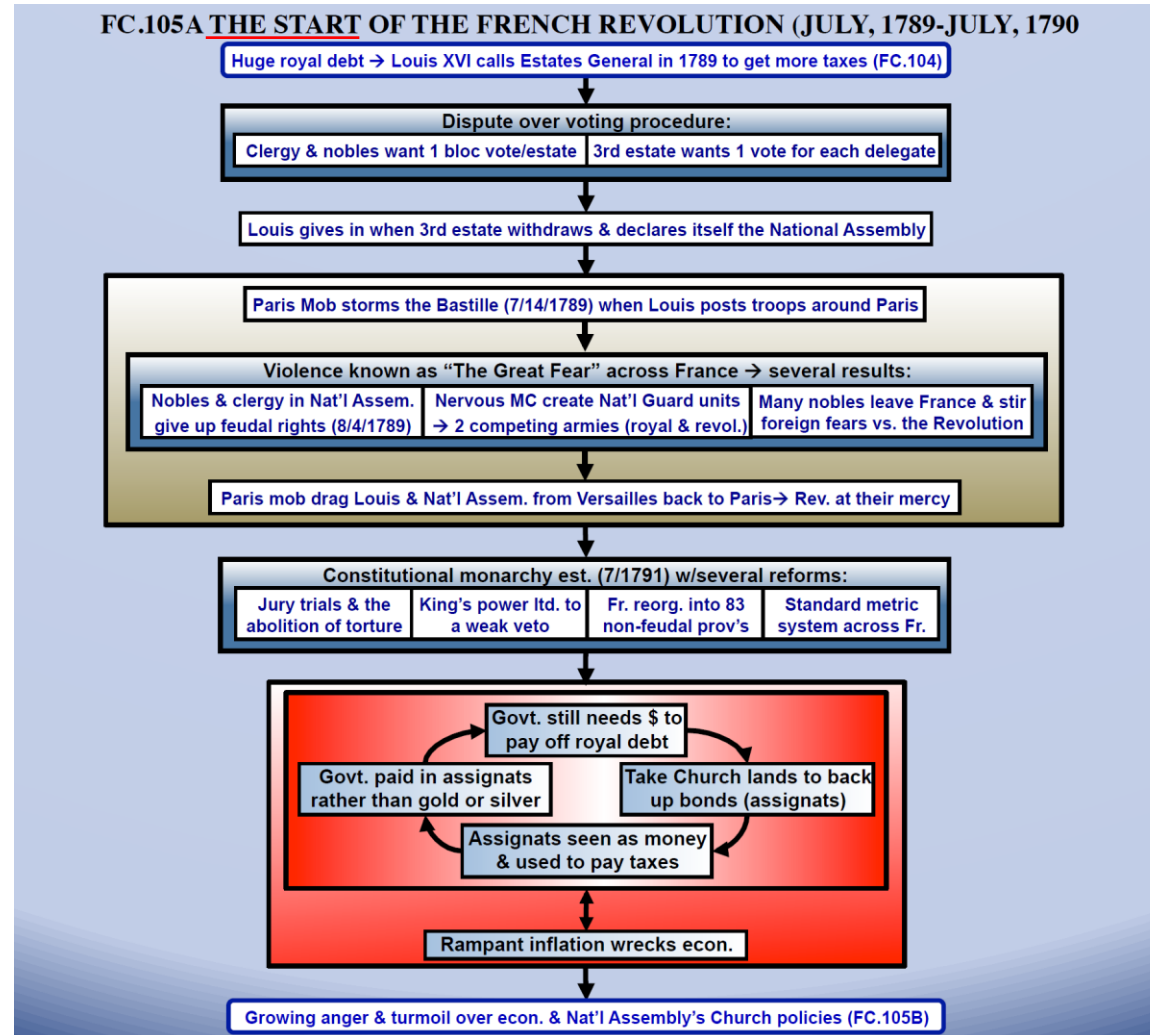
What about the role of the rise of democracy in America?

Some say that the Americans' victory over the British has been the single impact on the French revolution, and that the newly formed government in the United States became a model for the French reformers.

- Ideally, at multiple levels of granularities
 - And accounting for multiple perspectives and interpretations

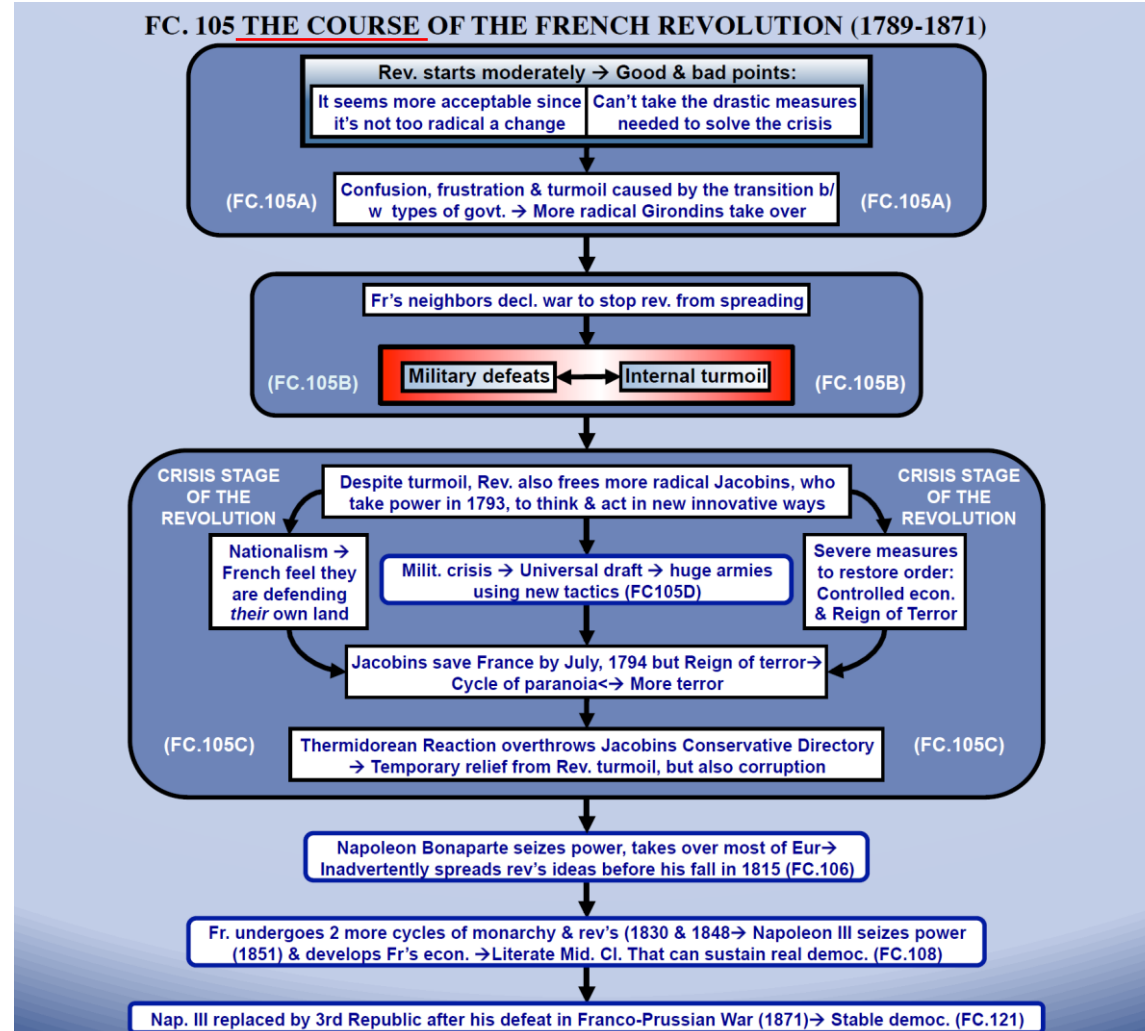
The history of Democracy

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- Ideally, at multiple levels of granularities
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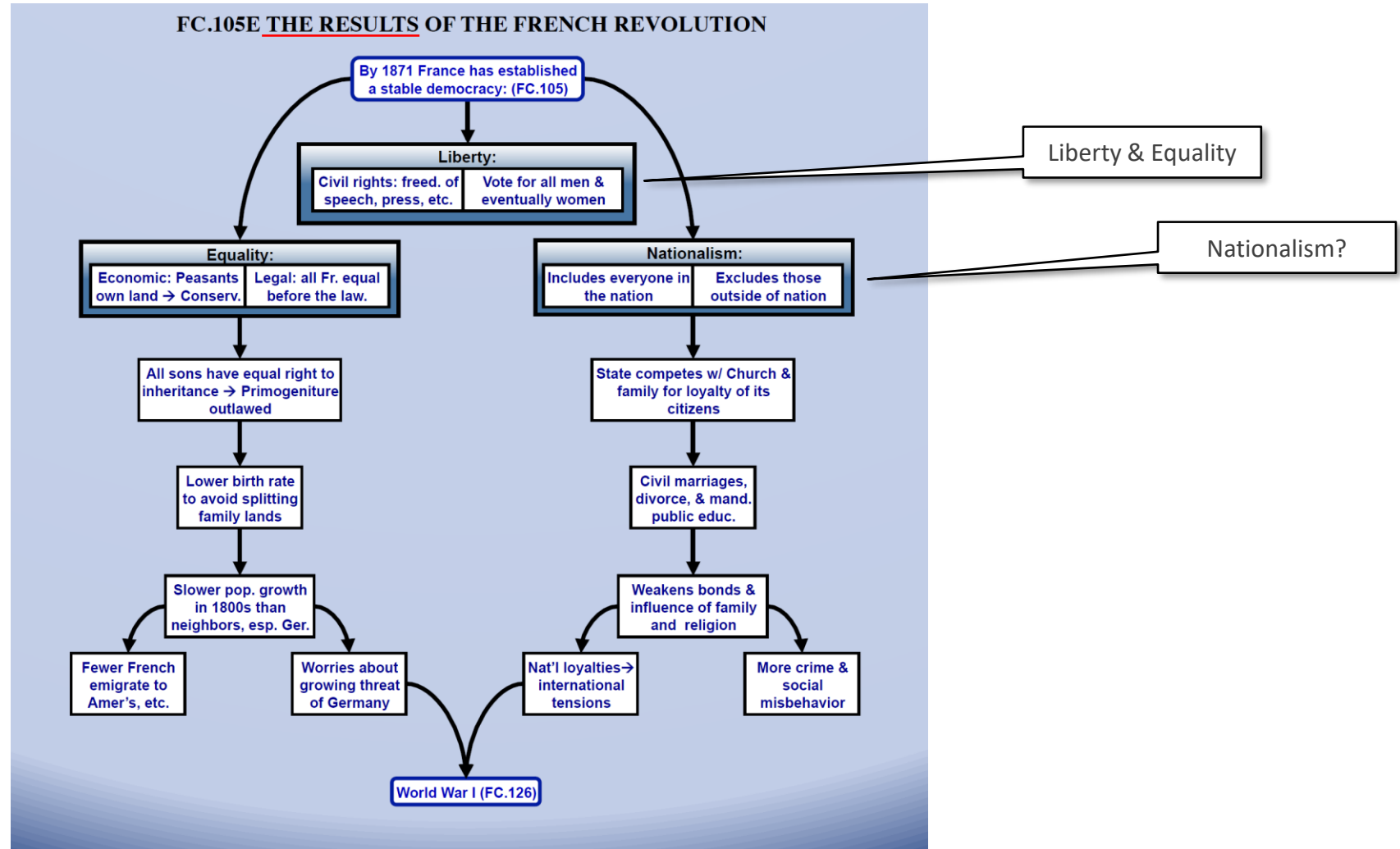
The history of Democracy



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- Ideally, at multiple levels of granularities
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The history of Democracy

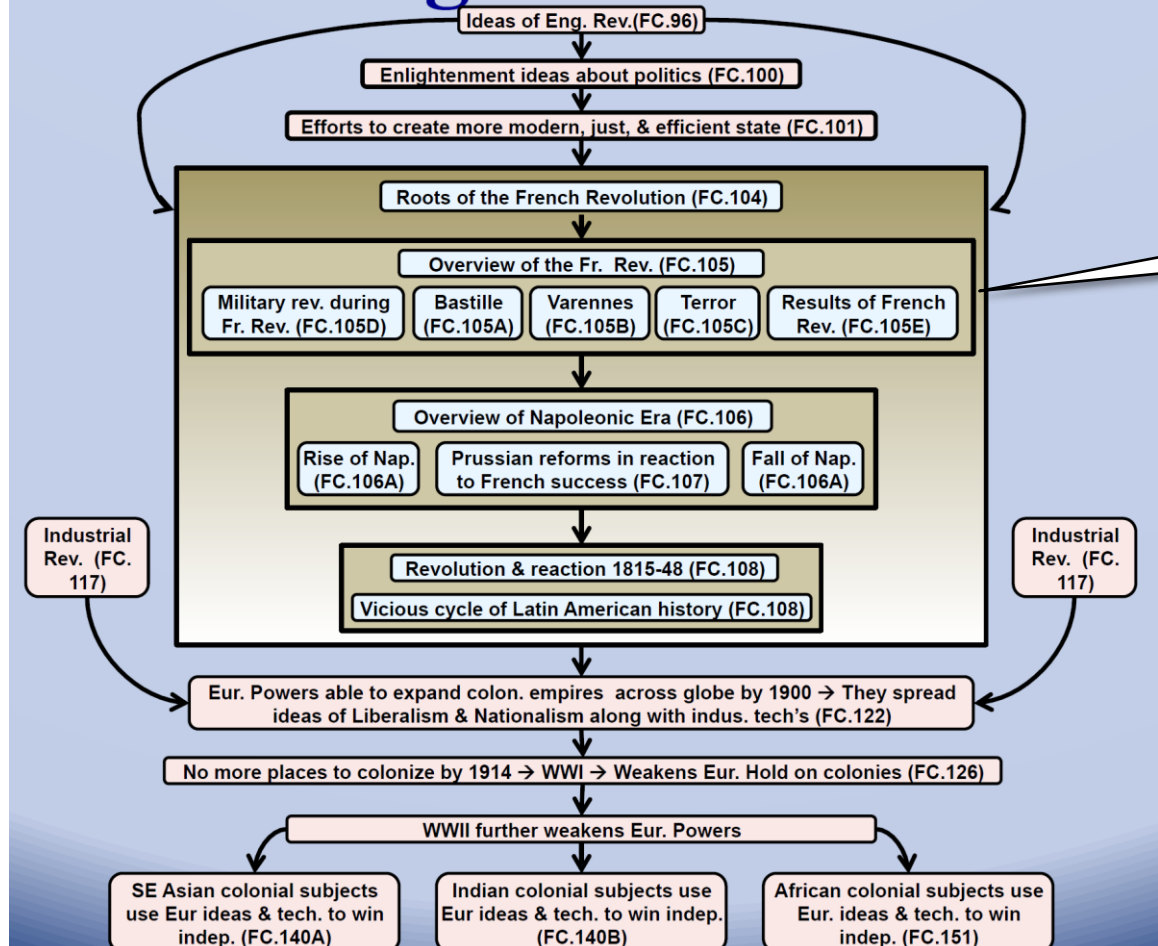


Credit: The Flow of History, by Chris Butler

- Ideally, at multiple levels of granularities
 - And accounting for multiple perspectives and interpretations

The history of Democracy

13. The Age of Revolutions



The place of the French revolution in the bigger picture

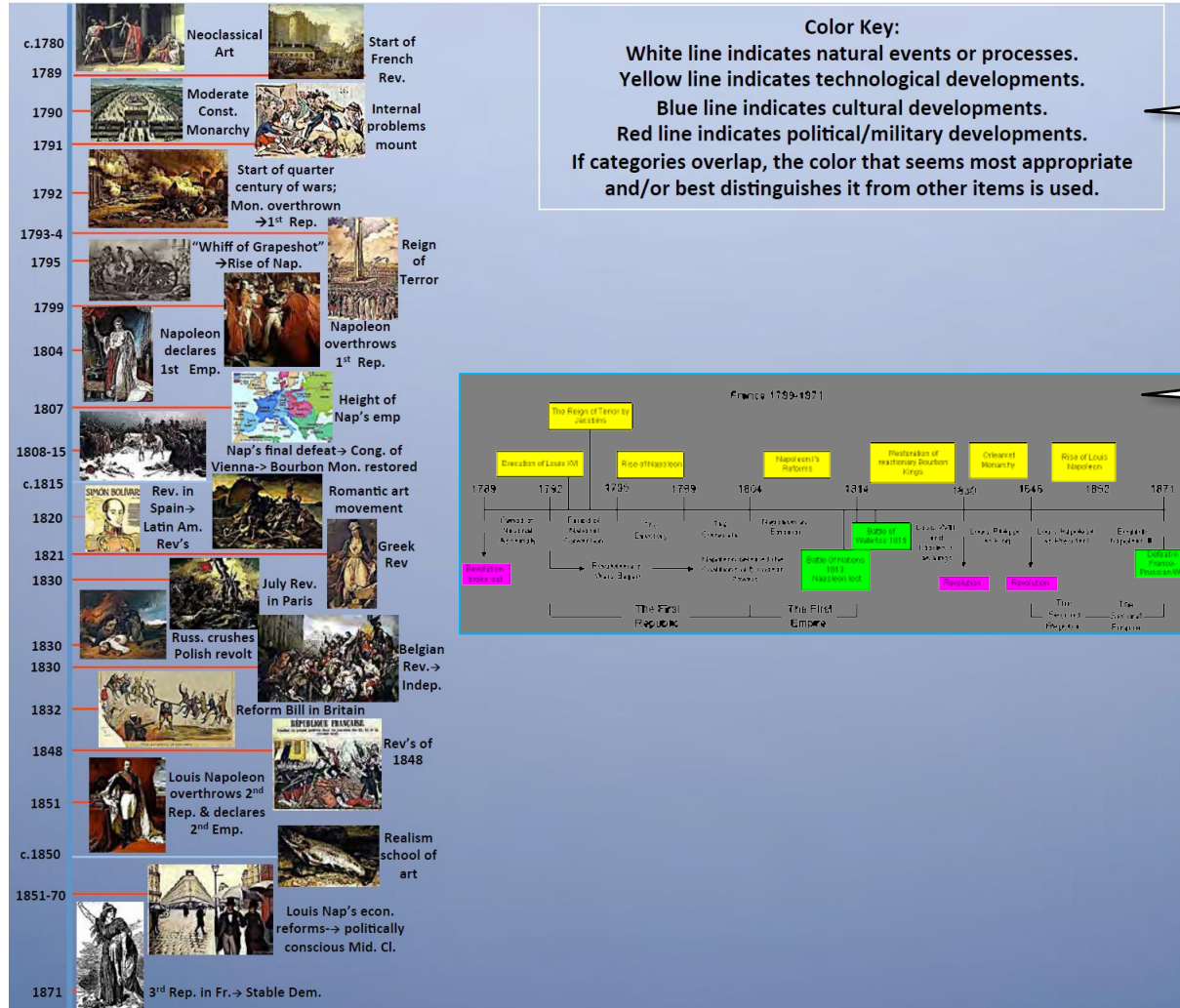
Credit: The Flow of History, by Chris Butler

Compiling a History Book – Timeline

- Ideally, at multiple levels of granularities
 - And accounting for multiple perspectives and interpretations

The history of Democracy

- One way to start is with the French revolution



Various types of processes and developments

Zoom in

It is challenging to compile such an account given a lot of historical text, and even more so to build it from reported events, as we they occur.

Credit: The Flow of History, by Chris Butler

This Tutorial

Event Extraction

- Event Definition and Representation

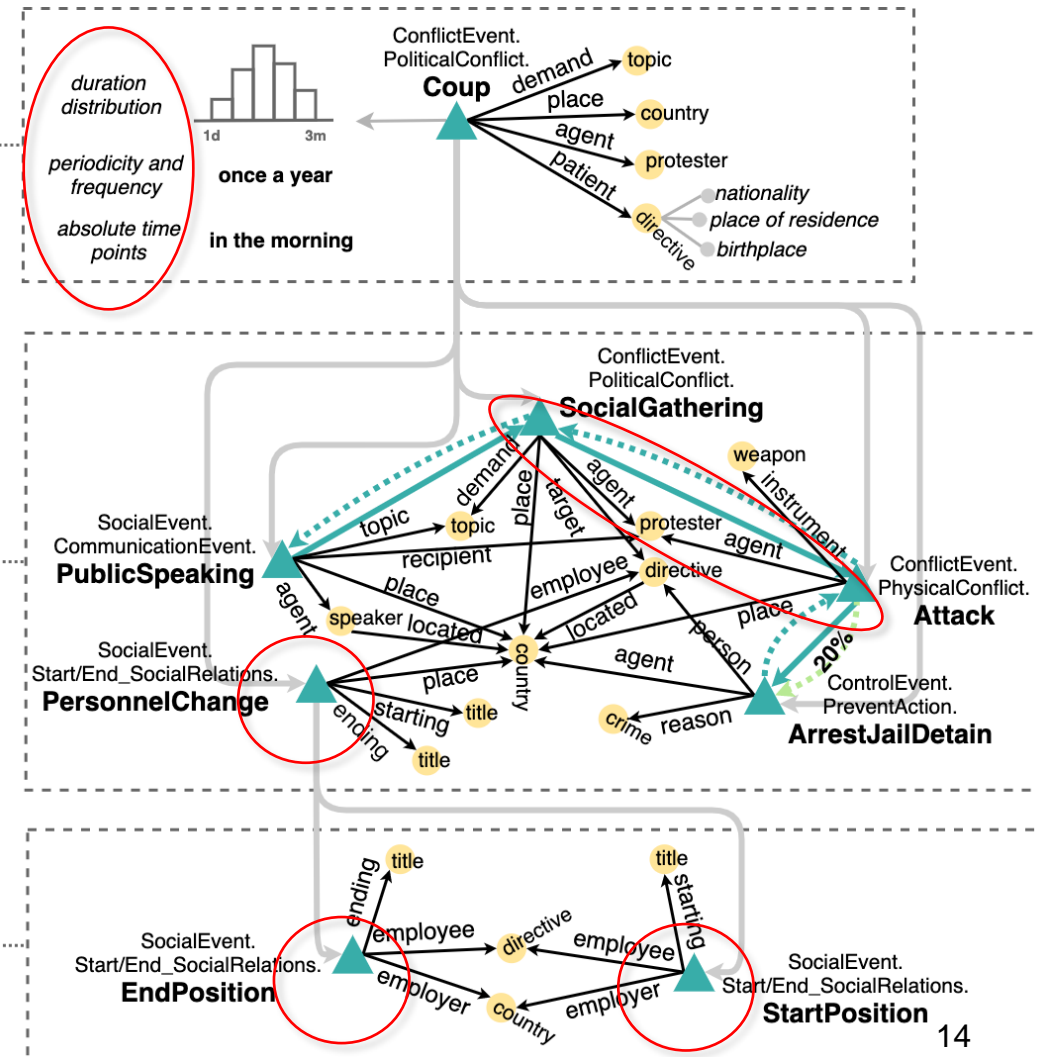
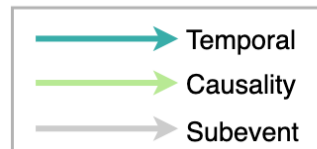
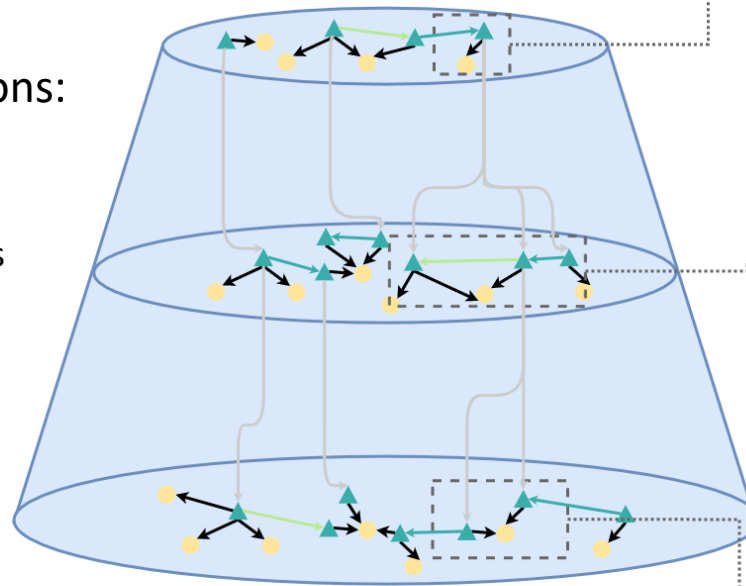
- Event Extraction

- From Supervised to zero-shot
- Cross-media event extraction

- Hierarchies, event schemas

- Event-event Relations:

- Coreference
- Sub-events
- Temporal Relations



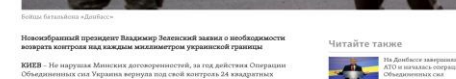
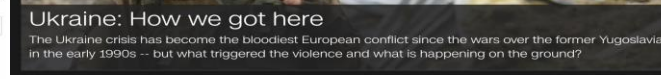
Multisource, Multimedia, Multilingual Data



STORY HIGHLIGHTS

Congress and Ukraine long sought anti-tank weapons in battle against separatists

(CNN) — The US is going to provide lethal anti-tank weapons to Ukraine to help it fight off separatists which have the backing of Russia, a senior State Department official told CNN.

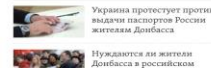


Президент России Владимир Путин (архивное фото)

В преддверии указа Владимира Путина была упрощен порядок предоставления гражданства жителями Донбасса

КНДВ — Россия упрощает порядок получения гражданства для украинцев, временно проживающих на ее территории, украинским бойцам, жителям отдельных районов Донецкой и Луганской областей, а также другим категориям граждан из Украины и ряда стран.

Читайте также



Американский ракетный эсминец Preble

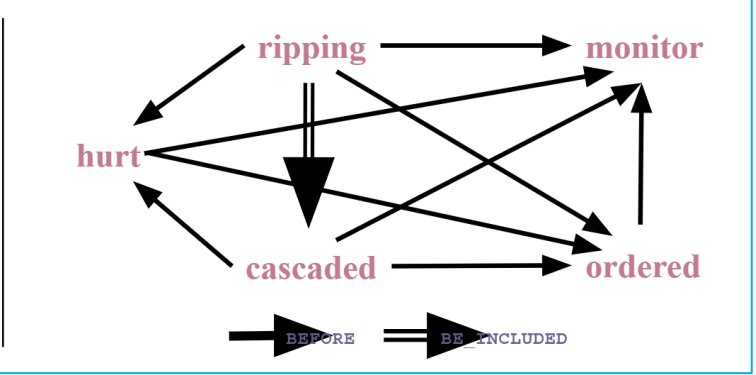
Американські військові повідомили, що два військові кораблі США пройшли поблизу островів, на які претендує Китай, у Південно-Китайському морі в понеділок. Ці дії розгнівали Пекін у час напружених зв'язків між двома найбільшими економіками світу.

□ Event extraction needs to be done across multiple sources and multiple modalities

Relations between Events

- Types of events
- Relations:
 - Coreference, Temporal, parent-child
- Incorporating knowledge constraints
 - Declarative, Statistical

In Los Angeles that lesson was brought home Friday when tons of earth **cascaded** down a hillside, **ripping** two houses from their foundations. No one was **hurt**, but firefighters **ordered** the evacuation of nearby homes and said they'll **monitor** the shifting ground until March 23rd.



$$\hat{I} = \arg \max_{I_r} \sum_{i < j} \sum_r f_r(ij) I_r(ij)$$

real variable boolean variable

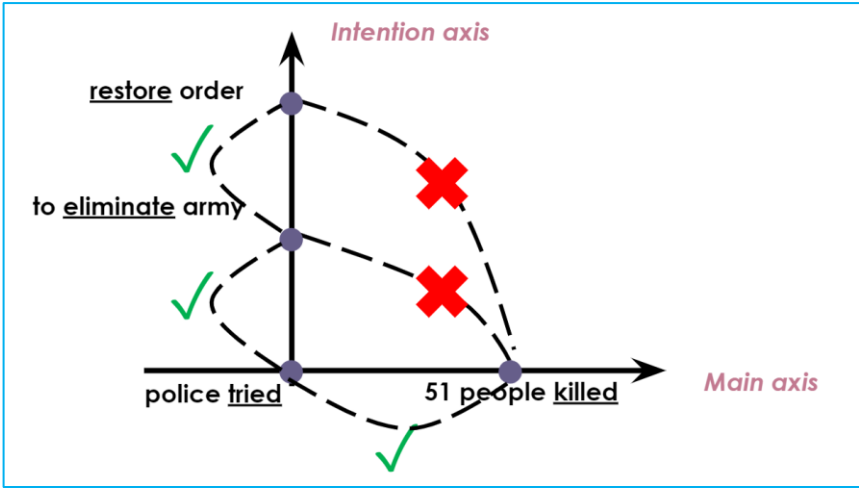
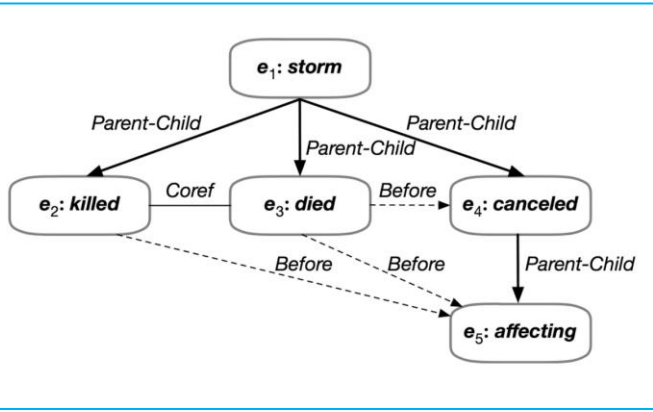
s.t. $\forall i, j, k$

$$\sum_r I_r(ij) = 1, \quad I_{r1}(ij) + I_{r2}(jk) - I_{r3}(ik) \leq 1$$

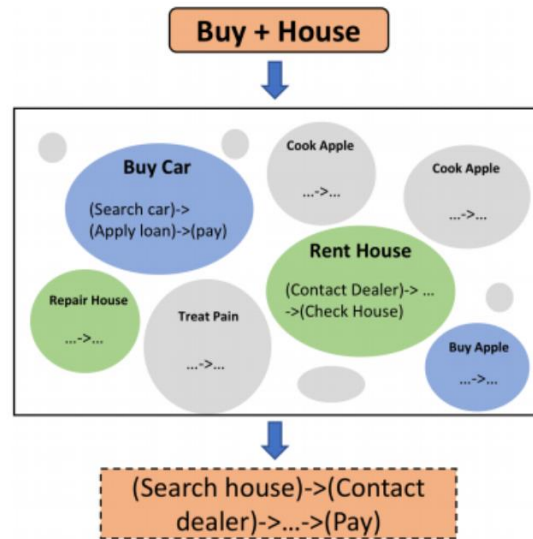
Uniqueness Transitivity (no loops)

Police **tried to eliminate** the pro-independence army and **restore order**. At least 51 people were **killed** in clashes between police and citizens in the troubled region.

On Tuesday, there was a typhoon-strength (e_1 :**storm**) in Japan. One man got (e_2 :**killed**) and thousands of people were left stranded. Police said an 81-year-old man (e_3 :**died**) in central Toyama when the wind blew over a shed, trapping him underneath. Later this afternoon, with the agency warning of possible tornadoes, Japan Airlines (e_4 :**cancel**) 230 domestic flights, (e_5 :**affecting**) 31,600 passengers.

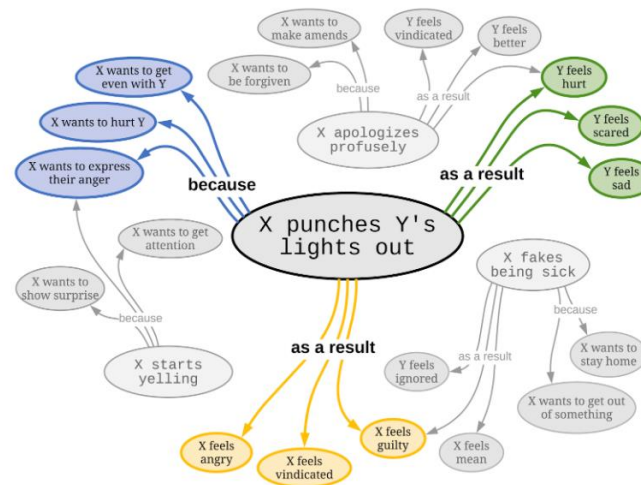


1. Event process completion



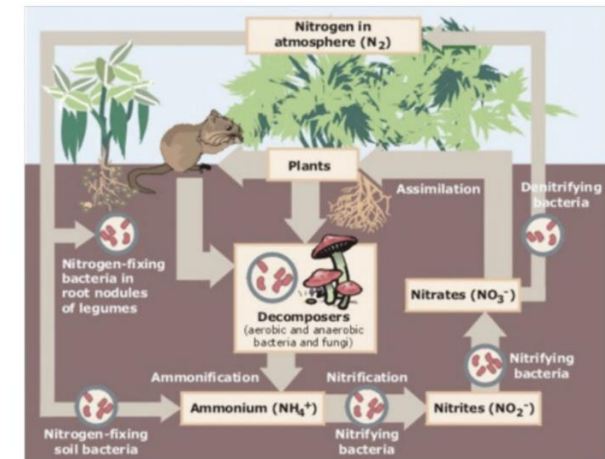
How to do this task?

2. Event intention prediction



What are they doing?

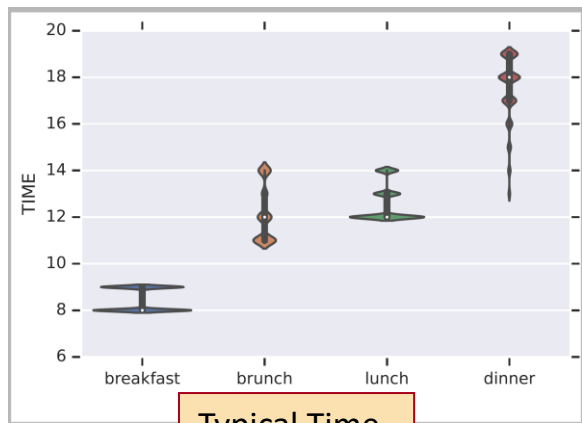
3. Event processes in downstream NLU tasks



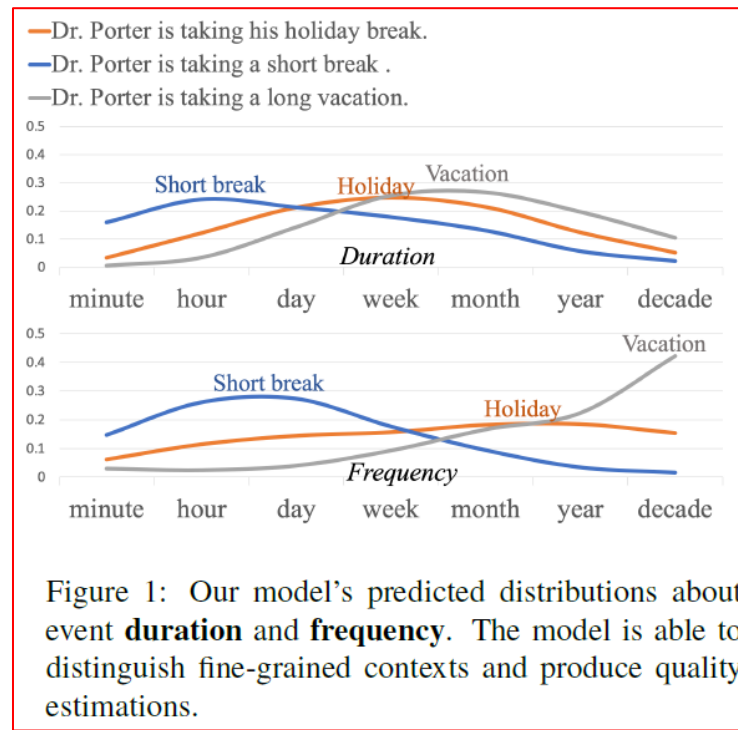
Narrative development

Background and Commonsense Knowledge

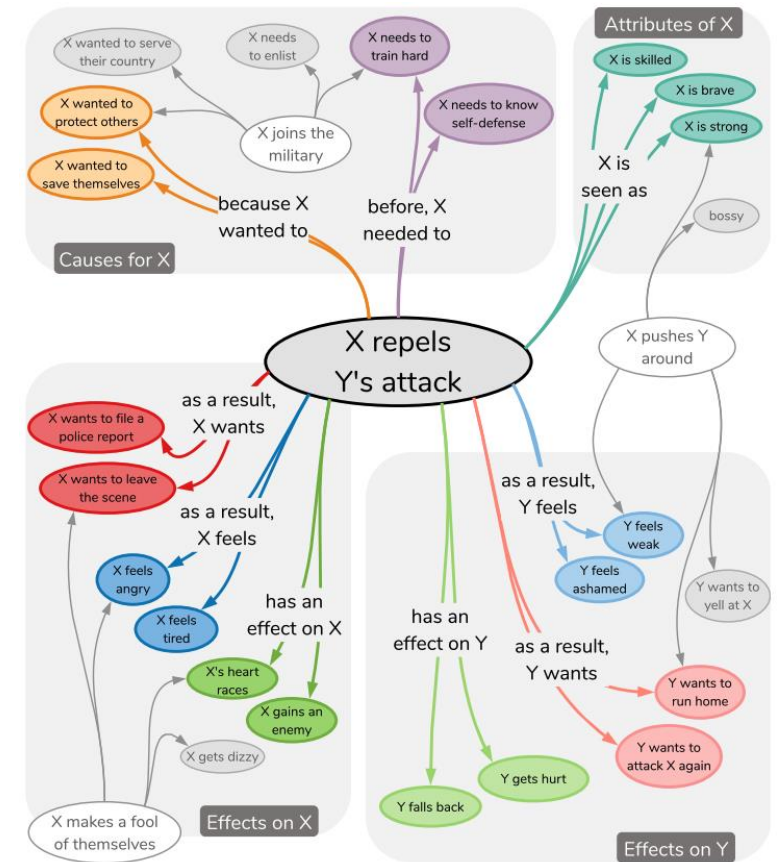
- Knowledge Resources that are important to facilitate reasoning about events.
- Commonsense: Event Relations
- Temporal Commonsense



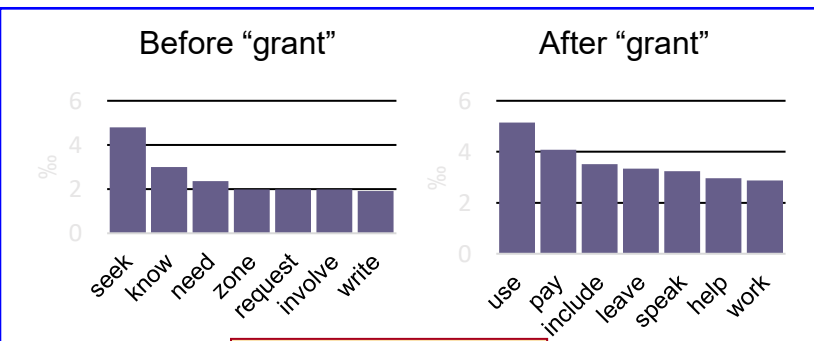
Typical Time [Elazar et al. ACL'19]



[Zhou et al. ACL'20]



Bosselut et al. ACL'19]



Typical Temporal Relations [Ning et al. NAACL'18]

- Introduction 20 min.
 - Dan Roth
- Event-Centric Information Extraction 40 min.
 - Heng Ji, Manling Li
- Event-Centric Information Extraction: Relations 30 min.
 - Qiang Ning
- Break 30 min.
- Event-Centric Prediction: Processes 35 min.
 - Muhao Chen
- Event-Centric Knowledge Acquisition: Commonsense 35 min.
 - Hongming Zhang
- Conclusion and Future Work 20 min.
 - Heng Ji, Dan Roth

The End

