



Semantic frames of causality in FrameNet and their application to Croatian

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DIKA

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- 6 researchers and 1 doctoral student:
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 - Ivana Brač, Maja Lončar, Ana Ostroški Anić, Martina Pavić (Institute of Croatian Language and Linguistics)

Project goals

- research of terminological units and specialized knowledge categories at conceptual and linguistic levels
- parallel corpus in the domain of air traffic
- syntactic and semantic analyses of the domains of aviation, marketing, law, carstology and music
- contrastive analyses of the translation equivalents in Croatian, English, German and French
- terminological database of semantic frames **AirFrame** – fundamental semantic frames of aviation (Flight, Airplane, Airspace, Airport, Air_traffic, and Air_traffic_control) + top level general language frames from FrameNet

need for **linking general language and specialized resources**

Causation – relevance for NLP

causation = relationship between two events, where the occurrence of the first event results in the occurrence of the second one.

- detection of causal relations from text based on large volumes of cause-effect event pairs
 - detecting cause-effect relations in medical documents, learning about after effects of natural disasters, learning causes for safety related incidents, etc.
 - machine translation, event prediction, developing language learning applications, etc.
- two common differentiations (Hendrickx et al. 2009; Sorgente et al. 2013):
 - a) marked** (there is a linguistic signal of causation present, e.g. *because*) and **unmarked** (*Drive slowly. It's raining.*) causality
 - b) explicit** (both cause and effect stated) and **implicit** (*The car ran over his leg.*) causality

Causality in FrameNet

14 general frames expressing causality (based on Vieu et al. 2016)

- | | |
|------------------------|----------------------|
| • Causation | Cause_to_start |
| • Contingency | Evidence |
| • Explaining_the_facts | Transitive_action |
| • Launch_process | Objective_influence |
| • Make_possible_to_do | Preventing |
| • Reason | Response |
| • Sign | Intentionally_affect |

four kinds of causalities (Dunietz et al. 2015)

- *consequence* (similar to the CAUSATION frame in FrameNet)
- *motivation* (similar to REASON)
- *purpose* (similar to PURPOSE)
- *inference* (similar to EVIDENCE)

Frames related to causation (*selection*)

Cause_change – *alter.v, alteration.n, change.v, conversion.n, convert.v, deform.v, make.v, modification.n, modify.v, reshape.v, shift.v, transform.v, transformation.n, turn.v, variation.n, vary.v*

Cause_emotion – *affront.n, affront.v, call name.v, concern.v, insult.n, insult.v, offend.v, offense.n, offensive.a*

Cause_impact – *bang.v, clang.v, clash.v, clatter.v, click.v, clink.v, collide.v, crash.v, graze.v, hit.v, jab.v, plow.v, ram.v, rap.v, rattle.v, run.v, rustle.v, slam.v, slap.v, smack.v, strike.v, thud.v, thump.v*

Cause_motion – *attract.v, cast.v, catapult.v, chuck.v, drag.v, draw.v, drive.v, drop.v, fling.v, force.v, haul.v, hit.v, hurl.v, impel.v, jerk.v, knock.v, launch.v, lift.v, move.v, nudge.v, pitch.v, press.v, propel.v, pull.v, punt.v, push.v, rake.v, roll.v, run.v, scoot.v, shove.v, slam.v, slide.v, stick.v, throw.v, thrust.v, toss.v, transfer.v, tug.v, wrench.v, wrest.v, yank.v*

Cause_to_experience – *amuse.v, divert.v, entertain.v, terrorize.v, torment.v*

Cause_to_land – *land.v, set down.v*

Cause_to_start – *actuate.v, arouse.v, bring about.v, call forth.v, create.v, elicit.v, engender.v, excite.v, generate.v, incite.v, instigate.v, kindle.v, motivate.v, produce.v, prompt.v, provoke.v, set off.v, spark.v, stimulate.v, stir up.v, trigger.v*

Cause_to_percieve – *bring to attention.v, demonstrate.v, depict.v, exhibit.v, point.v, present.v, present[medical].v, represent.v, show.v*

Cause_expansion – *aggrandizement.n, augmentation.n, blow up.v, compress.v, compression.n, condense.v, contraction.n, dilate.v, enlarge.v, enlargement.n, expand.v, expansion.n, grow.v, growth.n, inflate.v, lengthen.v, magnification.n, magnify.v, narrow.v, reduction.n, shrink.v, stretch.v, swell.v, widen.v*

Cause_harm – *bash.v, batter.v, bayonet.v, beat up.v, beat.v, belt.v, biff.v, bludgeon.v, boil.v, break.v, bruise.v, buffet.v, burn.v, butt.v, cane.v, chop.v, claw.v, clout.v, club.v, crack.v, crush.v, cudgel.v, cuff.v, cut.v, drug.v, elbow.v, electrocute.v, electrocution.n, flagellate.v, flog.v, fracture.v, gash.v, hammer.v, hit.v, horsewhip.v, hurt.v, impale.v, injure.v, jab.v, kick.v, knee.v, knife.v, knock.v, lash.v, maim.v, maul.v, mutilate.v, pelt.v, poison.v, poisoning.n, pummel.v, punch.v, run through.v, slap.v, slice.v, smack.v, smash.v, spear.v, squash.v, stab.v, sting.v, stone.v, strike.n, strike.v, swipe.v, thwack.v, torture.v, transfix.v, twist.v, welt.v, whip.v, wound.v*

Cause_temperature_change – *chill.v, cool down.v, cool.v, heat up.v, heat.v, overheat.v, refrigerate.v, reheat.v, warm up.v, warm.v*

Cause_to_make_noise – *beep.v, blare.v, blast.v, clang.v, clash.v, creak.v, honk.v, peep.v, play.v, ring.v, ringer.n, sound.v, tinkle.v, toll.v, toot.v, trumpet.v*

Cause_to_make_progress – *advance.v, develop.v, gains.n, improve.v, improved.a, mature.v, modernization.n, perfect.v*

Cause_to_wake – *awaken.v, get up.v, rouse.v, wake up.v, wake.v*

Causality in specialized semantic frames

AirFrame: database of specialized semantic frames of aviation

database structure (MySQL relational database)

semantic frames of aviation

- frame elements (definitions and examples in Croatian, English and French)

- lexical units

- frame-to-frame relations

frames = categories of knowledge

frame elements = frame-specific **semantic roles**

frame element type = types of semantic roles (ontological categories)

lexical units = **terms**

Defining aviation semantic frames

Concept modeling in AirFrame

1. defining aviation semantic frames
2. defining top-level semantic frames (FrameNet)
3. establishing semantic relations between them (on the level of frames, not specific frame elements)

Syntactic annotation and semantic role labeling – independent of the database; experimental stage

- specialized corpus of Croatian aviation language (within the project)
- Croatian general language corpus *hrWaC*

Aim and methodology

- conduct an analysis of lexical units related to the frame of **Causation** in FrameNet (English lexical units → Croatian equivalents → sentence annotation)
- examples from general language corpus (hrWaC) and specialized aviation corpus
- 40 sentences per target word (20 from each corpus, where possible)
- differences between the structure of English and Croatian frames

uzrokovati, v. 'cause, v.'

poticati, v. / *potaknuti*, v. 'encourage, v. / prompt, v. [intransitive/transitive]'

rezultirati, v. 'result (in), v.'

dovesti (do), v. 'lead (to), v.'

razlog, n. 'reason, n.'

uzrok, n. 'cause, n.'

Causation

Definition:

A **Cause** causes an **Effect**. Alternatively, an **Actor**, a participant of a (implicit) **Cause**, may stand in for the **Cause**. The entity **Affected** by the Causation may stand in for the overall **Effect** situation or event.

Those frames that inherit the Causation frame have as their background the idea that some event is responsible for the occurrence of another event (or state). In the inheriting frame, typically an FE like Agent or Causer is proposed in the place of the **Actor**, but in the daughter frames, as in this frame, the **Actor** is semantically dependent on the idea of a **Cause** (an event or state-of-affairs) that the **Actor** is a participant in. Similarly, most inheriting frames profile only the **Affected** entity, not the full **Effect** situation which is often incorporated into the frame or the particular target. So, for example, paint.v in the Filling frame entails the final situation of something (the **Affected**) being covered in paint (the **Effect**).

He **MADE** me angry.

If such a small earthquake **CAUSES** problems, just imagine a big one!

The strange mutations of the rumor mill in the end **LED** to it being said that he was actually a woman.

You've **MADE** it impossible to continue!

The ending **LEFT** me feeling kinda empty.

FEs:

Core:

Actor [act]
Semantic Type: Sentient

An entity which participates in a **Cause**, perhaps volitionally and perhaps not.

That one stone, apparently, **CAUSED** the avalanche that engulfed square miles of forest.

Stephen Hawking **CAUSED** an uproar when the results were published.

Affected [Affected]

Agents in a joint or reciprocal action (e.g. exchange)

Core Unexpressed:

Cause [Cause]

A force, process, or event that produces an effect.

The wind **MADE** the door rattle.

The accident **CAUSED** them to be more careful the next time.

Effect [Effect]

A positive or negative evaluation of the Phenomenon.

Non-Core:

Circumstances [cir]

Circumstances describe the state of the world (at a particular time and place) which is specifically independent of the event itself and any of its participants.

Concessive [con]

This FE signifies that the state of affairs expressed by the main clause (containing the target) occurs or holds, and something other than that state of affairs would be expected given the state of affairs in the concessive clause.

Explanation [exp]
Semantic Type: State_of_affairs

The **Explanation** denotes a proposition from which the main clause (headed by the target) logically follows. This often means that the **Explanation** causes the target's proposition, but not in all cases.

Frequency [fre]

How often the action denoted by the target occurs.

Manner [man]

Any holistic description of the event, including overall depictions (the same way) and descriptions pertaining to the **Actor**'s influence on the character of the event (eagerly, quietly).

Means [mea]

An action through which the **Actor** or **Cause** accomplishes the action indicated by the target.

Place [Place]

Where the event takes place.

Time [Time]
Semantic Type: Time

This FE identifies the **Time** when the event occurs.

Results

(1) Neka ova igra [Cause] POTAKNE potišten, usnuo i nesvjestan dio nas [Affected] na promjenu [Effect].

‘Let this game ENCOURAGE the depressed, sleepy and unconscious part of us to change.’

(2) Na taj se dan [Time] POTIČU preventivne aktivnosti koje ukazuju na veliki javno-zdravstveni problem pušenja [Effect].
definite null instantiation (DNI)
(implicit cause)

‘On this day, preventive activities are ENCOURAGED that indicate a major public health problem of smoking.’

(3) Nakon svega nekoliko minuta, [Time] oksidacija [Cause] je UZROKOVALA oštećenje [Effect] koje vidite na desnoj polovici jabuke, [Place] dok je lijeva polovica zadržala svoj divan, svjež izgled [Effect] zbog prirodnih antioksidansa koje limunov sok sadrži [Cause].

‘After only a few minutes, the oxidation CAUSED the damage you see on the right half of the apple, while the left half has retained its lovely, fresh look due to the natural antioxidants that lemon juice contains.’

(4) Globalna ekonomska kriza [Cause] REZULTIRALA JE porastom nezaposlenosti i siromaštva [Effect] te smanjila gospodarske aktivnosti [Effect].

‘The global economic crisis has RESULTED in rising unemployment and poverty and reduced economic activity.’

(5) Ta ju [Affected] je ljubav [Cause] DOVELA do rata sa suparnicom [Effect] i u konačnici odvela u smrt [Effect].

‘That love LED her to war with a rival and eventually led to her death.’

(6) RAZLOG bijega [Effect] nije utvrđen, no pretpostavlja se kako je počinio nekakav prekršaj zbog kojeg je mogao biti zakonski gonjen [Cause].

‘The REASON for the escape has not been determined, but it is presumed that he committed some kind of offense for which he could have been prosecuted.’

(7) Smatra se da je alergija na mlijeko [Cause] najčešći UZROK anemije u djetinjstvu [Effect].

‘Milk allergy is considered to be the most common CAUSE of childhood anemia.’

Aviation context

(8) **Vučne sile** _[Actor] UZROKUJU **naprezanje krakova na savijanje u smjeru kretanja zrakoplova** _[Effect]•

‘Traction forces CAUSE the tension of the arms to bend in the direction of the aircraft.’

(9) Bilo je slučajeva u kojima je **aerodinamička pobuda pri relativno malim brzinama vjetra** _[Cause] DOVELA do **zamornog loma nosača** _[Effect] **u nosivoj konstrukciji mosta** _[Place]•

‘There have been cases in which aerodynamic excitation at relatively low wind speeds HAS LED TO fatigue fracture of the girder in the load-bearing structure of the bridge.’

(10) **Takve analize** _[Cause] REZULTIRAT ĆE **vrijednostima srednje mase za putnike i prtljagu** _[Effect] kao i **drugim podacima** _[Effect]•

‘Such analyses will RESULT in **average mass values for passengers and baggage** as well as other data.’

→ domain knowledge needed for correct annotation (*average mass values for passengers and baggage, not average mass + for passengers and baggage*)

(11) Promet civilnih zrakoplova izvan granica ^[Cause] POTAKNUO je zainteresirane države ^[Affected] na donošenje odluke o tome žele li trpjeti slobodno ulijetanje u svoj zračni prostor ili ih učiniti ovisnima o prethodnim dozvolama ^[Effect]•

‘The movement of civil aircraft across borders has PROMPTED interested states to decide whether they want to suffer free entry into their airspace or make them dependent on previous permits.’

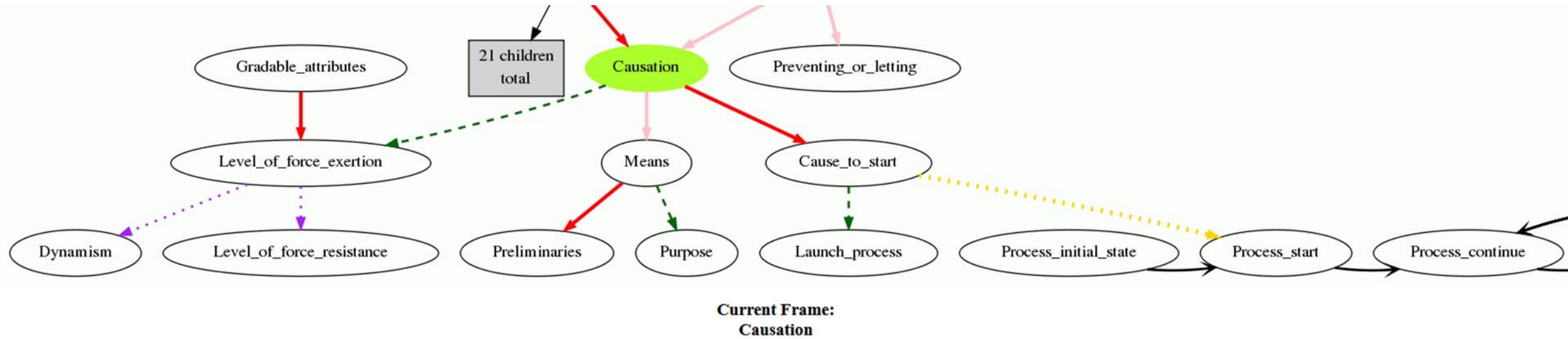
(12) Drugi UZROK vibracija elise ^[Effect] je promjenjiv zakretni moment motora ^[Cause]•

‘Another CAUSE of propeller vibration is a variable engine torque.’

(13) UZROK je tome ^[Effect] manja gustoća i veća provodljivost zraka na većim visinama ^[Cause]•

‘The REASON for this is lower density and higher air conductivity at higher altitudes.’

Frame relations between general and specialized frames



FrameNet

Causation \Rightarrow Cause_to_start
Causation \Rightarrow Cause_to_land

Frame-frame relations: *inherits from*
uses
causative_of

AirFrame

Vehicle_landing \Rightarrow Take_off
Vehicle_landing \Rightarrow Landing

Conclusions

- verbs typical lexical units for conveying causative relations
(Cro. *uzrokovati, potaknuti, dovesti do, rezultirati*, etc.)
- nouns more schematic, more contextually dependent, appear in more ambiguous examples (concerning semantic annotation)
- Croatian frames need to be adjusted (adding the non-core FE of Purpose to the Causation frame?)
- blurred lines between semantic frames of Reason and Causation
reason, n. as lexical unit listed in both frames

Causation frame

We can now see a REASON **for the disappearance of Garcia 's household** [Effect].

Reason frame

There was no REASON **for me to pull in** [Action].

That is the other REASON **I came today** [Action], for there is a task I have in mind.

There are persuasive REASONS **for doubting this** [Action].

I agree with the REASONS given **for having allowed the appeal** [Action].

Conclusions

Annotated as within the **Reason** frame

Nepredviđene zapreke_[State_of_Affairs] kao RAZLOG za otkaz putovanja_[Action]
određuje svako osiguravajuće društvo_[Agent] sukladno svojim uvjetima.

Annotated as within the **Causation** frame

Nepredviđene zapreke_[Cause] kao RAZLOG za otkaz putovanja_[Effect] određuje svako
osiguravajuće društvo_[Actor] sukladno svojim uvjetima_[Circumstances].

‘Unforeseen obstacles as a REASON for travel cancellation are determined by each insurance company in accordance with its conditions.’

- Causation: the background is the idea that some **event** is responsible for the occurrence of another **event** (or **state**).
- Reason: a **volitional Agent** is responding to a State_of_affairs by performing some Action.



Napredno pretraživanje



Naziv ↑

Thank you!

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