ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

Analyzing the Imagistic Foundation of Framality via Prepositions

Aldo Gangemi, Dagmar Gromann

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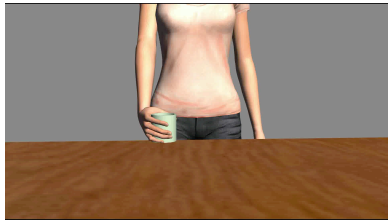
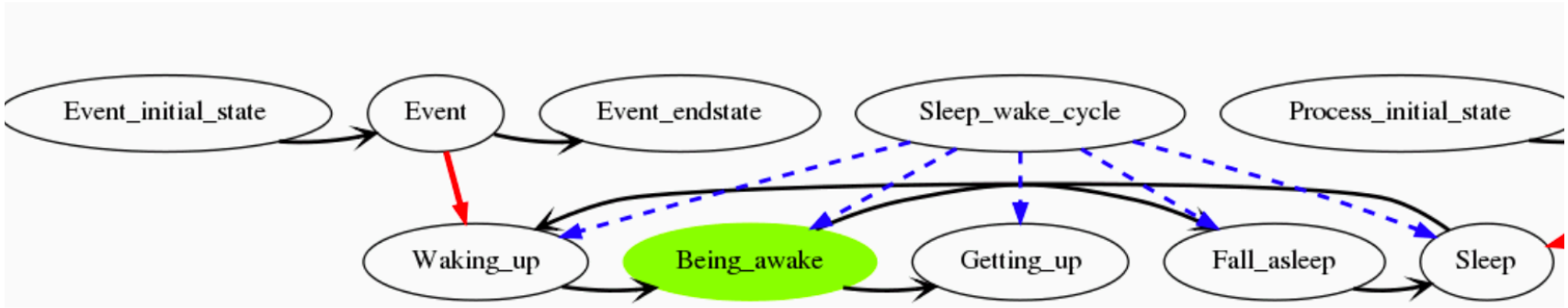
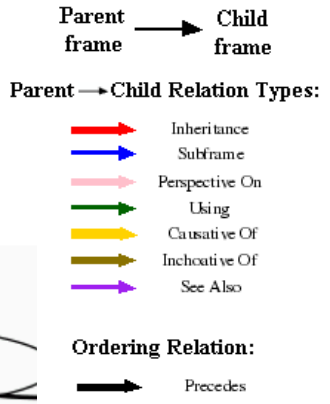
Imagistic Foundation

Image schema is “a recurring dynamic pattern of our perceptual interaction and motor programs that gives coherence and structure to our experience” (Johnson 1987, xiv)

Image Schema	Physical Experience	Metaphor	Example
CONTAINMENT		CONTAINER FOR CONTAINED	go for a glass, the whole town participated
PATH		LIFE IS A JOURNEY	to be on track, career path, life path

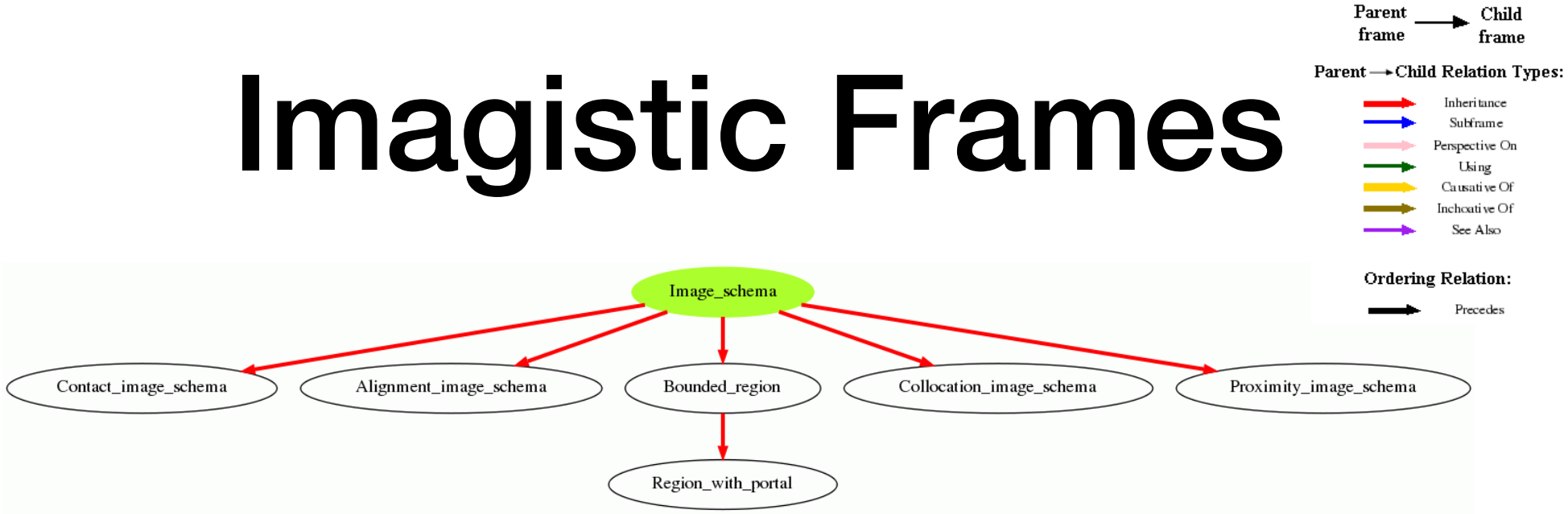
Framality





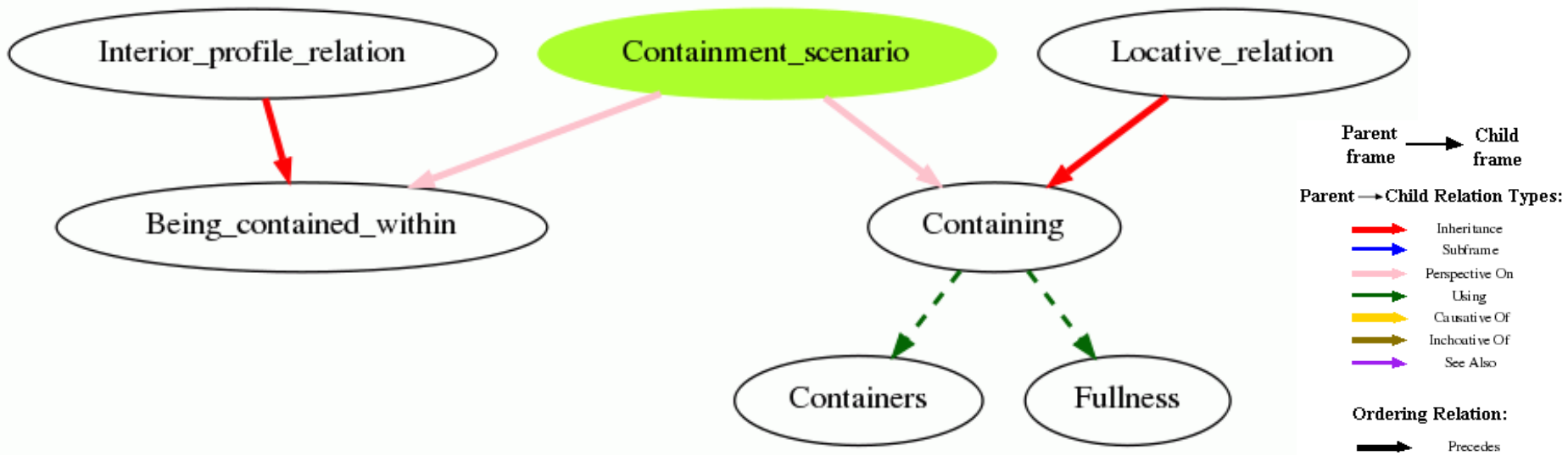
- FrameNet was proposed to unite linguistic and commonsense knowledge; based on frame semantics (Fillmore 2006)
- Frames describe a type of object, event or situation
- Frames are interrelated (see legend to the top right)
- Frames may be marked as lexical, i.e., have a lexicalization (e.g. `Locative_relation` is associated with lexical units `above-ground.a`, `near.a`, `near.prep`, etc.), or non-lexical, i.e., have no natural language realization associated with them (e.g. `Source_path_goal`)

Imagistic Frames



- One non-lexical top-level frame is called `Image_schema` is associated with the high-level definition "A Profiled_region is picked out relative to a Ground."
- Five frames directly inherit from `Image_schema`, namely:
  - `Alignment_image_schema`,
  - `Bounded_region`,
  - `Collocation_image_schema`,
  - `Contact_image_schema`,
  - `Proximity_image_schema`
- Many image schemas missing, e.g. SOURCE_PATH_GOAL

Potential Imagistic Frames



- Many potentially imagistic frames with no relation to `Image_schema`:
  - `Containment_scenario`
  - `Path_traveled`
  - `Hindering`
  - `Cause_Impact`

Idea

- Semantic roles as binary projections of frames, e.g. CONTAINMENT can be projected as a
  - “Container” role, a
  - “ConcaveObject” type, or as a
  - “Contains” binary relation between a “ConcaveObject” and a smaller “Object”.

- Image schemas as set of finite roles evoked by role-like projections of frames

- Full top-level foundation of frames in imagistic frames

- Start with a subgraph of existing imagistic frames based on observations from textual inputs (i.e. prepositions) and their mappings to frames

Motivation

- Systematic analysis of imagistic foundation of frames
- Some imagistic frames exist, however, incomplete and inconsistent + non-standard semantics
- Prepositions are central to defining spatio-temporal relations in natural language, which makes them a highly reasonable choice for analyzing image schemas
- Starting from preposition senses we analyze the explicit and implicit image-schematic foundation of frames in Framester

Preposition Senses

Frame	Frame Element	Lexical Unit	GF	PT	Preposition
Arriving	Mode_of_transportation	arrive.v	Comp	PP	by
Arriving	Mode_of_transportation	arrive.v	Comp	PP	in

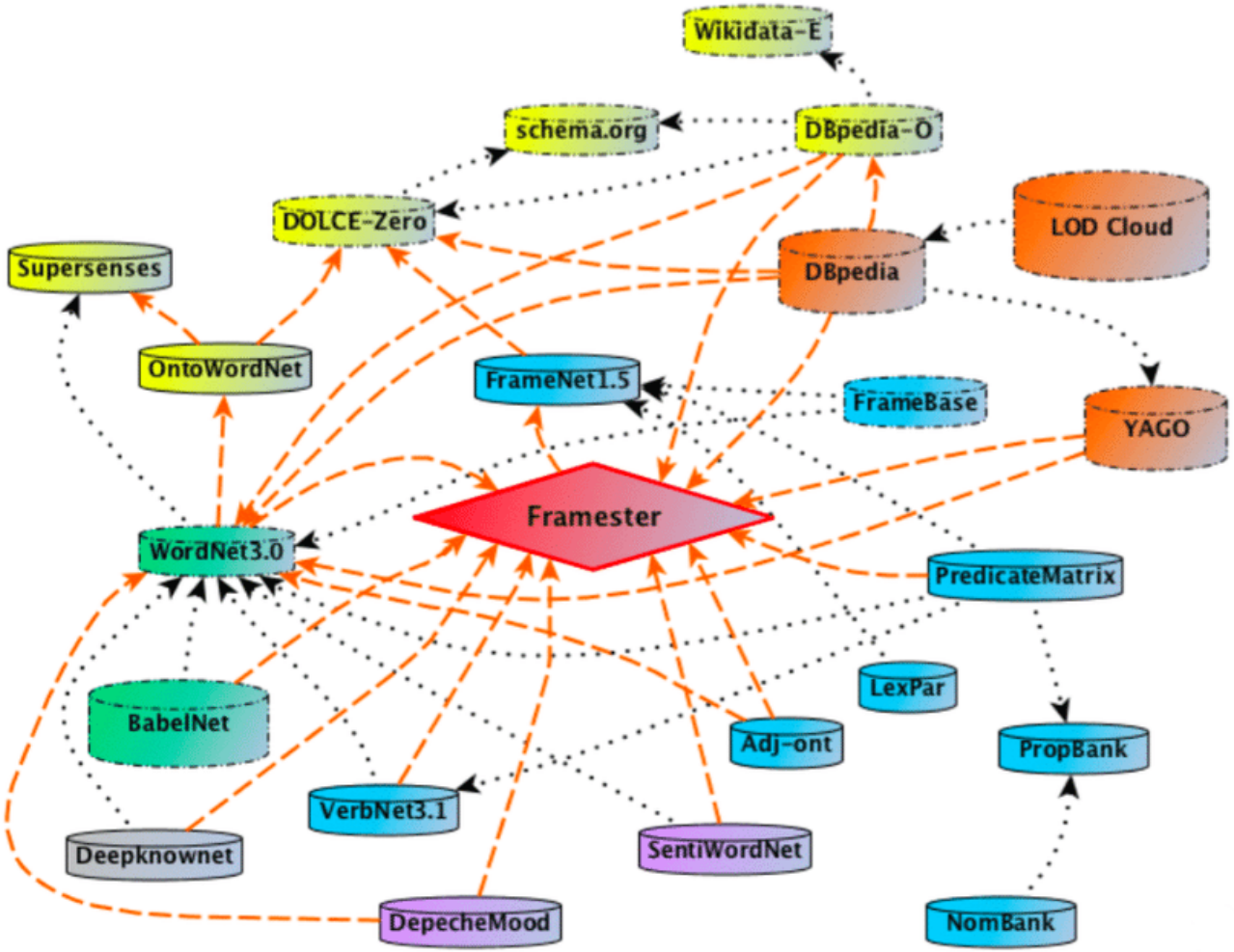
Source: https://www.clres.com/prepositions.html

- *The Preposition Project (TPP)*: capture semantics of all prepositions in the English language and annotate with frames from FrameNet

- 373 prepositions including phrasal prepositions; 847 preposition senses

Framester

Semiotic hub for knowledge graph interoperability.



Extracting Frames

1. extract all frames relating to preposition senses by way of `inheritsFrom` relation explicitly linking to imagistic frames (relation or mentioning “image schema” in their definition)

2. query all preposition senses with a mapping to a frame element and a corresponding frame utilizing Framester and manually analyze their image-schematic content

3. extract all frames related to lexical units of prepositions and manually analyze their definitions for their image-schematic content

Identified Frames

1. Frames mentioning “image schema”: `Trajector-Landmark`, `Containment`, `Containment_relation_IS`, `Goal`, `SourcePathGoal`

2. Candidate frames by relation: `Body_movement`, `Motion_scenario`, `Cause_to_start`, `Container_focused_removing`, `Hindering`, etc.

3. Candidate frames by lexical unit: `Goal`, `Surrounding`, `Bounded_region`, etc.

Examples Method 2: Extracting by Relation

PART-WHOLE	Being_included, Inclusion_scenario, Wholes_and_parts, Part_whole, Part_piece, Shaped_part, Grinding, Cause_to_fragment	through, under, alongside, within, via
CONTAINMENT	Containers, Containing, Container_focused_removing, Abounding_with, In, Ingest_substance, Bounded_entity, Containment_relation_IS, Container_focused_removing, Container_focused_placing	on, next to, inside, above, atop, about, underneath
BLOCKAGE	Hindering, Impact, Cause_impact, Thwarting	on the part of, with, over, against
CONTACT	Attaching, Inchoative_attaching, Being_attached	within, into, in

Non-Imagistic Frames

- Manner (*handle with care*, prepsense_000564045_3)
- Topic (*about image schemas*, prepsense_000342956_18)
- Cause (*because of her smile*, prepsense_000193438_11)
- Temporal (*during this hour*, prepsense_000193438_11)
- verbal nouns and object relation (*payment of his debts*, prepsense_000342956_0)
- Beneficiary (*a present for you*, prepsense_000193438_0)
- Possession (*decision of the Council*, prepsense_000342956_2)
- Agents (*done by my cousin*, prepsense_000143452_16)
- Material (*made of wood*, prepsense_000342956_14

Observations

- Most common imagistic frames detected are related to SOURCE_PATH_GOAL and CONTAINMENT
- Some overlap of detected frames across all three methods, however, also frames only identified by one of the three methods
- Further annotations needed (crowdsourcing?) for borderline cases, e.g. `Contacting` - establishing communication channel, but also image-schema?

Conclusions

- Numerous spatio-temporal / imagistic frames without any direct link to `Image_schema` – combination of methods needed to detect imagistic frames (linguistic structures, relations, definition analysis)

- Contributing a first analysis with three methods to a potential systematic grounding of frames in image schemas

- Aiming towards a full top-level imagistic foundation of framality as an inventory of cognitively motivated semantic roles

References

Fillmore, C. J. (2006). Frame semantics. *Cognitive linguistics: Basic readings*, *34*, 373-400.

Johnson, M. (1987). The Body in the Mind: The Bodily Basis of Meaning, Imagination, and Reason. The University of Chicago Press, Chicago and London.