

ECG Constructions and FrameNet: Possible implications for MLFN

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Overview

- Embodied Construction Grammar (ECG) -- background
- Building ECG constructions and frames using FrameNet (FN) data
- Integrated development of constructions and frames
 - Challenges
 - Possible implications for FrameNet(s) and Multi-lingual FrameNet
- Future directions

Embodied Construction Grammar (ECG)

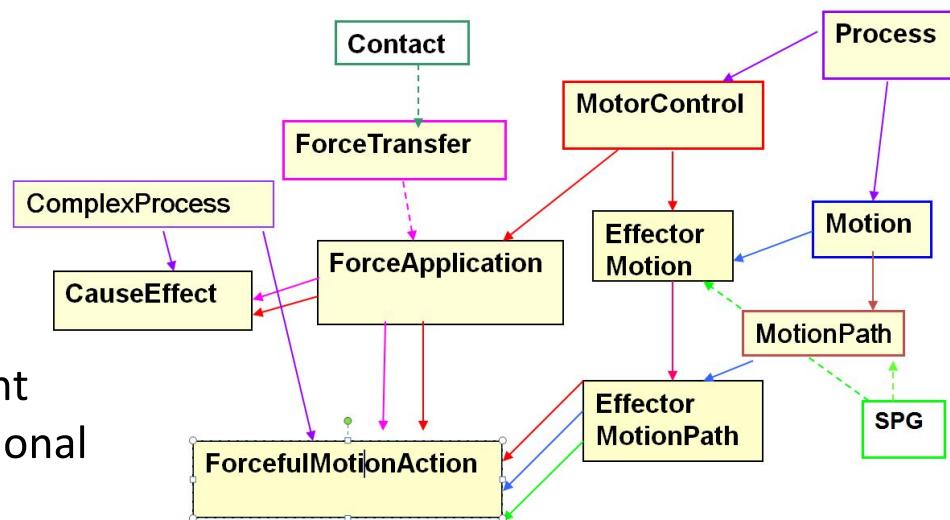
Constructional meaning represented using frames

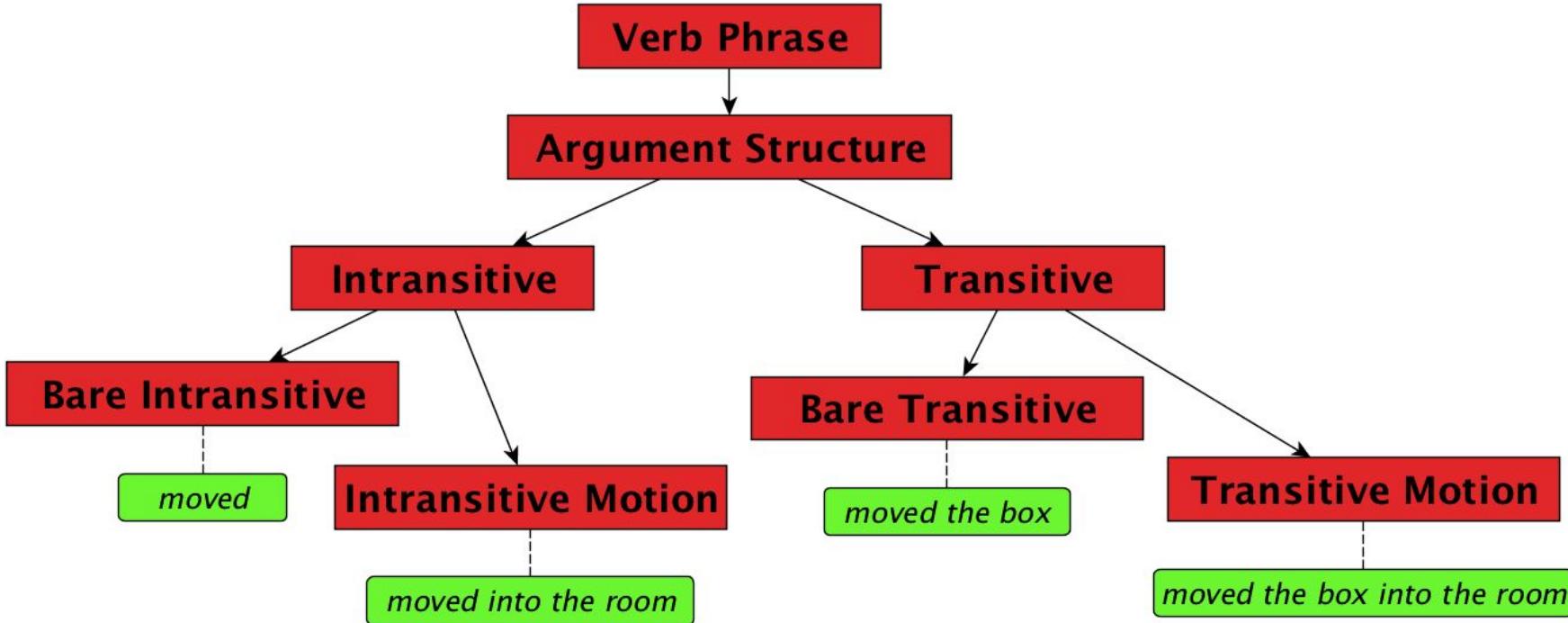
Grammar:

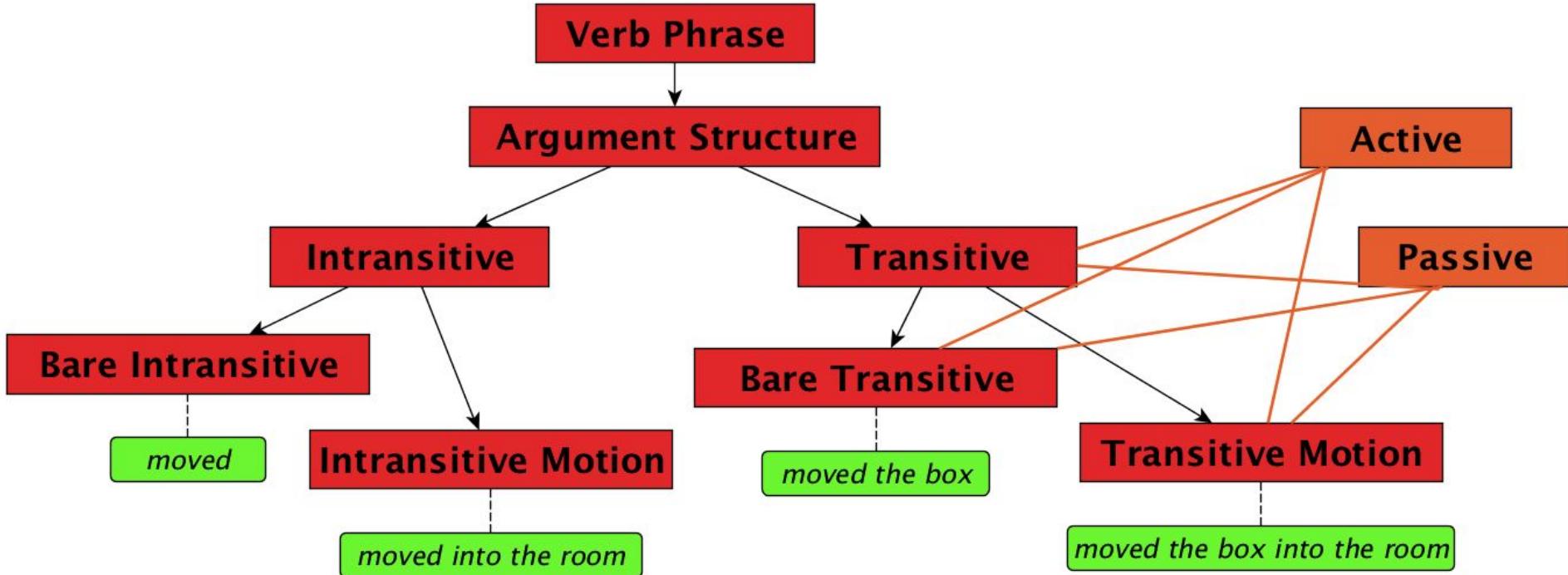
- consists of (lattices of) **frames** and **constructions**
- Is designed to support compositional, unification-based analysis of **sentence meaning**

Computational tools:

- ECG workbench for grammar development
- Constructional Analyzer for full constructional sentence analysis
- Part of system for text-based interaction with (simulated) robot







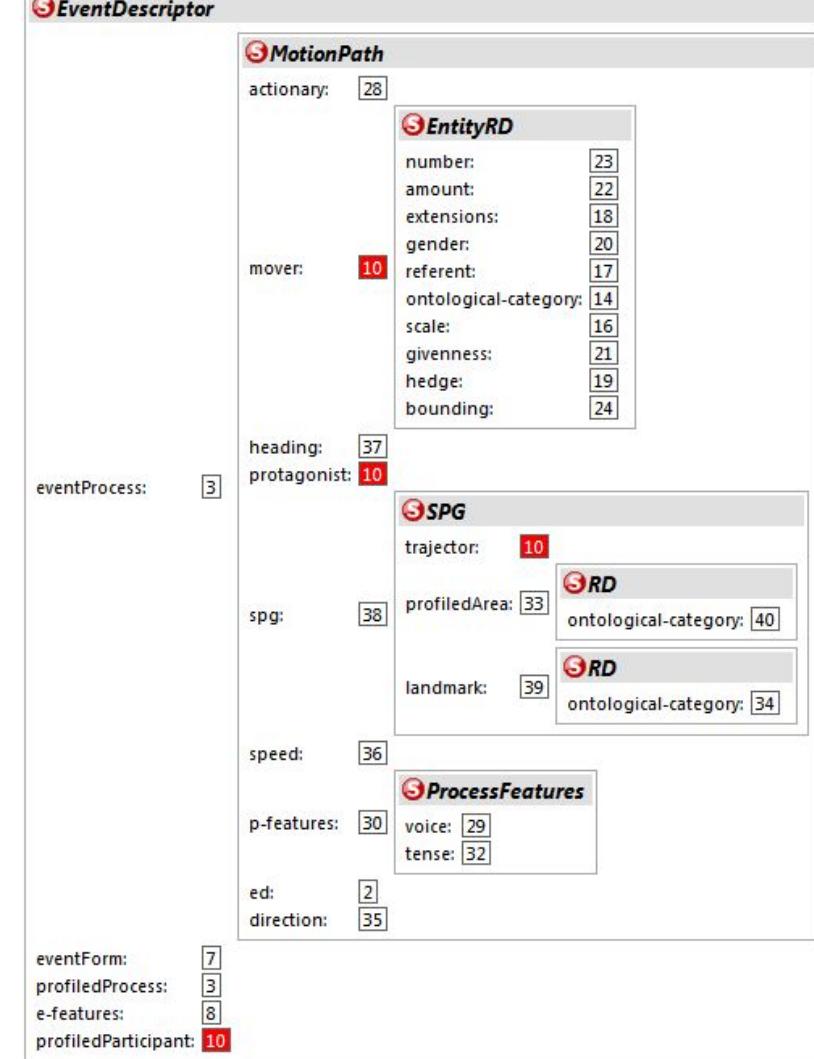
Constructional and Conceptual Composition

Frame-based meaning

He walked into the room

ECG can capture complex meaning via:

- Complex frames
- Constructional composition



Different Types/Levels of Constructions

- Lexical constructions
- Domain-specific phrasal constructions (e.g. verb-argument structure)
- Domain-general, grammatical constructions

Domain-general, grammatical constructions

- Sentences, noun phrases, relative clauses, TAM-related constructions, etc.
- Meaning:
 - ECG: EventDescriptor, Referent Descriptor, and other schemas
 - FN may not have necessary frames
- Need to identify and represent these constructions these in order to:
 - Capture full sentence meaning
 - Unpack annotated valence patterns

Lexical Constructions

- FN LUs provide word form and frame-level meaning
- ECG cxns provide means to distinguish between meanings of LUs in a frame, using:
 - relations to additional frames (e.g. spatial relations frames),
 - semantic type constraints (e.g. more specific types of theme)
 - Parameter values (e.g. speed of motion)
- FN implications:
 - Handle lexical distinctions via frames or constructions?
 - Affects granularity of frame definitions, lumping/splitting decisions

Verb Argument-Structure (A-S) Constructions

- Capture argument realization patterns at a general, non-verb-specific level
- Meaning is analyzed in terms of **frames** for various kinds of (typically basic) events
- A-S constructions in ECG grammars are defined as part of a larger lattice categories
- Meanings are compatible with FN frames
- FN valence patterns provide useful data

FN valence information

Catapult (TARGET) evokes the Cause_motion frame

Sentence	<i>William</i>	<i>catapulted</i>	<i>a lump of metal</i>	<i>into a classroom</i>
Cause Motion FEs	Agent	[TARGET]	Theme	Goal
Gram. Function	EXT		OBJ	DEP
Phrase Type	NP		NP	PP-into

Using FN valences for ECG cxns: Challenges

- Which parameters?
 - Frame Element, grammatical function, phrase type, ordering
- At what level of generalization?
 - Constructions. E.g. All PPs? Specific prepositions? Groups of prepositions?
 - Meaning. E.g. lexical, individual frame, groups of related frames
- How to analyze valence patterns in terms of composed constructions, e.g.:
 - Active and passive constructions
 - Declarative, imperative, wh-questions
 - Relative clauses

Constructional patterns

Description	Pattern
active transitive	Ext > V > Obj
active transitive plus optional NI FEs	Ext > V > Obj + (NI)
active transitive with dependent(s)	Ext > V > Obj > Dep
active transitive with dep(s), plus optional NI FEs	Ext > V > Obj > Dep + (NI)
intransitive/active passive	Ext > Verb
intransitive/active passive with dep(s)	Ext > Verb > Dep
intransitive/active passive, plus optional NI FEs	Ext > Verb > Dep + (NI)
Imperative	V > Obj > Dep
active trans with v > dep > obj	Ext > Dep > Obj > Many(Dep) + (NI)
active trans in subj relative clause	Ext > Ext > Obj > Many(Dep) + (NI)
active trans in Obj relative clause	Obj > Obj > Ext > Many(Dep) + (NI)

FN valence data: Cause_motion frame

Total count: 821

	freq.	Patterns
1	178	Ext: Agent (NP) → v → Obj: Theme (NP) → Dep: Goal (PP)
2	103	Ext: Agent (NP) → v → Obj: Theme (NP) → Dep: Path (PP)
3	48	Ext: Theme (NP) → v → Dep: Goal (PP) → CNI: Agent (None)
4	39	Ext: Agent (NP) → v → Obj: Theme (NP) → Dep: Source (PP)
5	18	Ext: Agent (NP) → v → Dep: Goal (PP) → Obj: Theme (NP)
6	17	Ext: Theme (NP) → v → Dep: Source (PP) → CNI: Agent (None)
7	17	Ext: Theme (NP) → v → Dep: Path (PP) → CNI: Agent (None)
8	12	Ext: Agent (NP) → v → Obj: Theme (NP) → Dep: Goal (AVP)

FN valence data: active transitive CauseMotion

Total count: 458

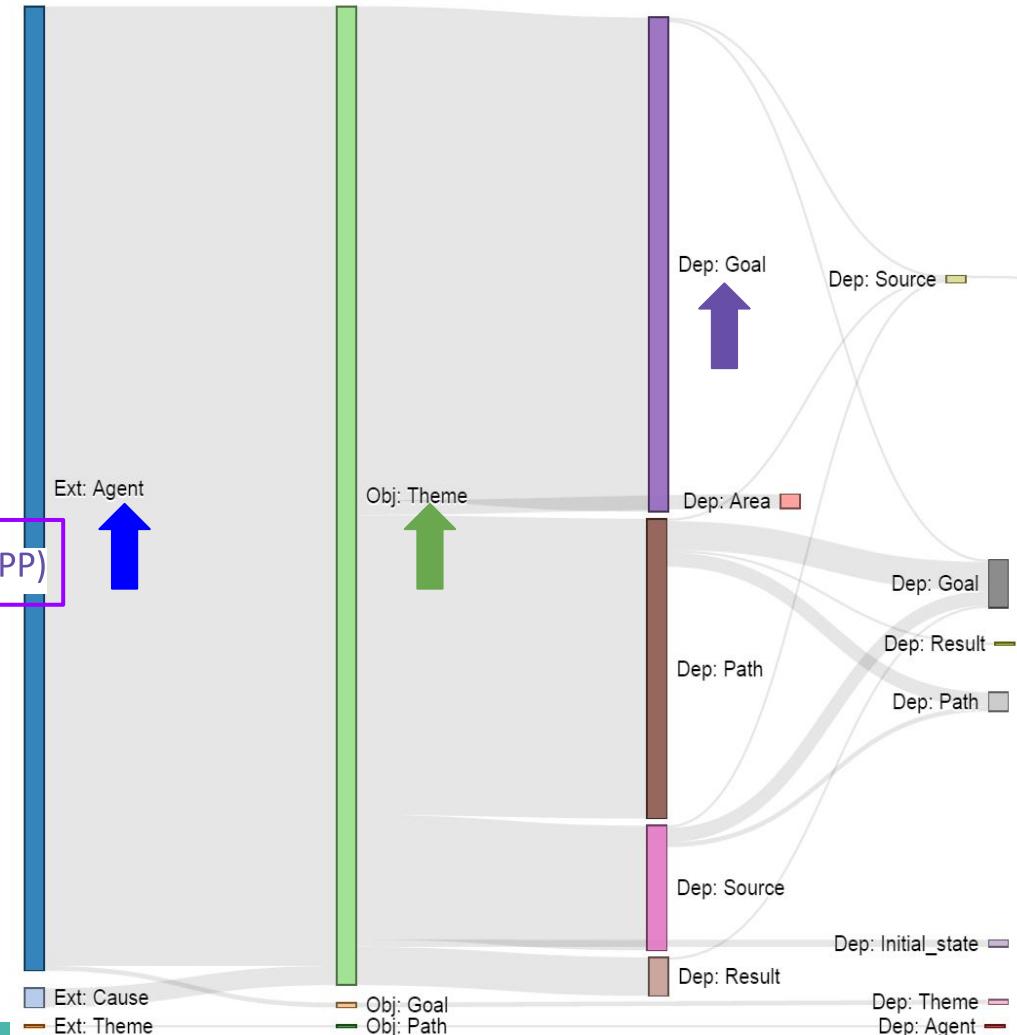
	freq.	Patterns
1	178	Ext: Agent (NP) → v → Obj: Theme (NP) → Dep: Goal (PP)
2	103	Ext: Agent (NP) → v → Obj: Theme (NP) → Dep: Path (PP)
3	39	Ext: Agent (NP) → v → Obj: Theme (NP) → Dep: Source (PP)
4	12	Ext: Agent (NP) → v → Obj: Theme (NP) → Dep: Goal (AVP) <ul style="list-style-type: none">When he came round , they dragged him outside and flung him in his night-clothes , into a car and handcuffed him ." Pooley stretched out a tentative boot to nudge the copper coin aside .Irritated , Merrill pushed her chair back .As he stood in uncertainty , still clutching his rupee , the people pushed him aside in their hurry to buy a little favour with divinity .Hastily , Benny shoved the guard outside , not bothering to check whether he was alive or not , and bolted the door .Liz shoved her chair back .He threw the letter aside , and went to stare at his Supper at Emmaus .

Cause_motion: Active Transitive

Example:

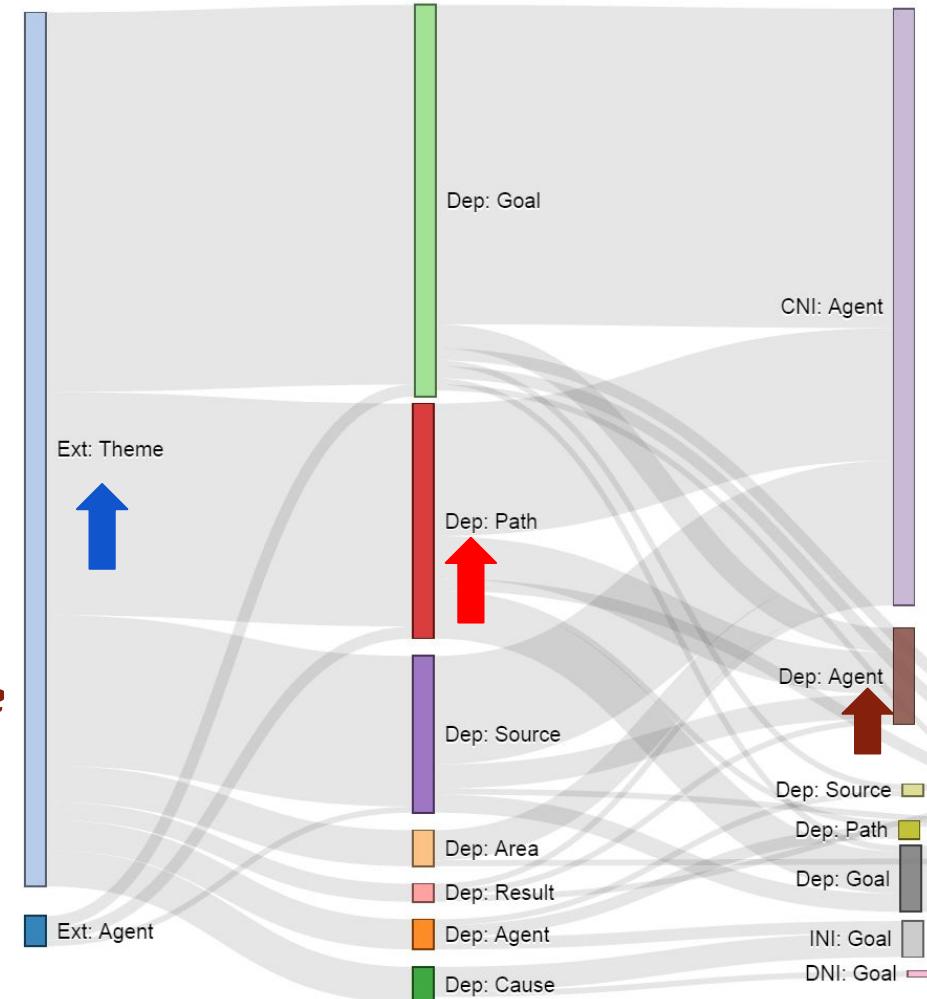
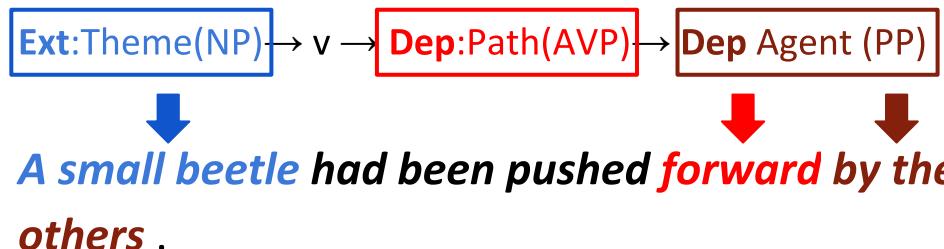


He chuck it into the sea



Cause_motion: Passive

Example:



Cause_motion: findings

- Fairly general syntactic patterns (which can be represented as constructions) account for many of the general ordering patterns we see in the data (GF realization).
 - E.g: Ext > V > Obj > Dep
- As charts show, there is a great deal of regularity in these linking patterns.
 - E.g. Ext:Agent, Obj:Theme, Dep:Goal/Path/Source
- To identify general A-S construction patterns, we need to disentangle them from other more general constructions

Variations on a scene: alternations

Two Cause fluidic motion: two valence patterns:

- Ext: **Agent (NP)** → v → Obj: **Fluid (NP)** → Dep: **Goal (PP)**

She splashed water on her face...

- Ext: **Agent (NP)** → v → Obj: **Goal (NP)** → Dep: **Fluid (PP)**

...an older woman splashes him with water

- How to capture differences in affectedness of Obj?

Variations on a scene: causation / transitivity

Cause_Fluidic_Motion:

<i>She</i>	<i>splashed</i>	<i>the</i>	<i>plants</i>	<i>with</i>	<i>water</i>
Agent	(action)	Goal		Fluid	

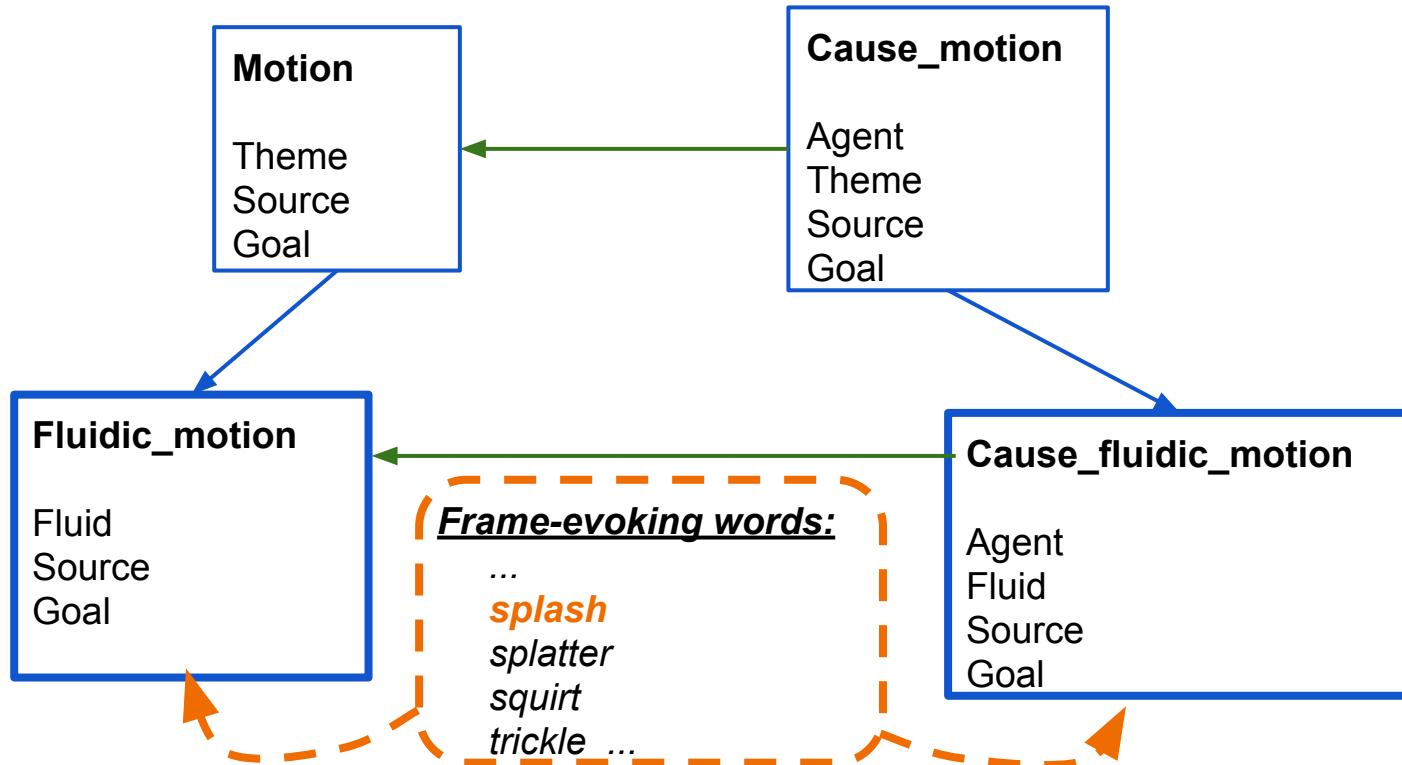
Cause_Fluidic_Motion:

<i>She</i>	<i>splashed</i>	<i>water</i>	<i>on</i>	<i>the</i>	<i>plants</i>
Agent	(action)	Fluid	Goal		

Fluidic_Motion:

<i>Water</i>	<i>splashed</i>	<i>on</i>	<i>the</i>	<i>plants</i>
Fluid	(action)	Goal		

Variations on a scene: causation / transitivity



Identifying Generalizations

- How general should constructions be?
 - Frame-level generalizations over valence patterns
 - Draw broader generalizations over multiple frames (e.g. using inheritance relations)
 - Keep in mind that general (more productive) constructions don't preclude more specific constructions
- How general should frames be?
 - Lexical constructions could be used to capture semantic distinctions that are currently handled by defining separate frames

Systems of frames?

Attributes, Statives, Inchoatives, Causatives

There are many possible ways of describing properties and states:

- attributes
- ongoing states
- changes of state (both into and out of a state)
- causal variants

Attribute	Stative	Inchoative	Causative
Fullness	Abounding_with	Distributed_position	Filling
full, fullness, empty	filled, full, brushed	fill, cover, over.prep	fill, flood, splash
a cup full of water	The cup is filled/full	The cup filled with water	He filled the cup
a full cup	a box full of glass		
			Emptying
his cup was empty			empty, debone, drain
an empty cup		The room emptied	He emptied the cup
			Removing
			empty, drain
		The water drained from the t	He emptied the water from the tub
Being_wet			Cause_to_be_wet
wet.a			wet, soak, dampen
wet clothes			He wet it with water
Being_dry		Becoming_dry	Cause_to_be_dry

Systems of frames?

Attributes, Statives, Inchoatives, Causatives

- How can we best capture these kinds of systematic relations?
 - Currently handled in BFN using frame-to-frame relations
 - Are sometimes ‘gaps’ in the system
 - Should we use similar structure as FN Brasil, that puts more weight on constructions and reduces the multiplication of frames?

Different packaging and lexicalization patterns

- FE incorporation -- *bag the groceries, put the groceries in a bag*
- Typological differences, e.g. path/manner distinctions
- Differences in granularity
 - Greater semantic density of LUs may be motivation to capture meaning differences via frames rather than constructions
 - Interlingual FN would need to have both general and more specific frames

Some Questions for FrameNet(s)

- How to address inconsistencies, fill in gaps in existing networks?
- How might the addition of constructions affect frame networks? E.g.:
 - Frame-to-frame relations (e.g. causative, inchoative, stative)?
 - The granularity at which frames are defined?
- To what extent, if any, should constructions be directly integrated into existing frame networks of individual FN projects? In Multi-lingual FrameNet?

Possible Future Work

Berkeley FN and/or Multi-lingual FN:

- Add discourse, grammatical function, and information structure frames to represent meanings of high-level, domain-general constructions
- Ground and further specify the meanings of frames by systematically linking them to more ‘abstract’ frames

Embodied Construction Grammar:

- Build a FN-based ECG grammar which would include FN frames, lexical constructions, and Argument Structure constructions derived from FN valence pattern data
- Multi-lingual ECG?

Thank you!