

Meanings are like Onions: a Layered Approach to Metaphor Processing

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weapon
law enforcement
victim
agent
place
CRIME
target domain

*The **crime epidemic** is affecting our cities* source domain

DISEASE
type
source agent patient doctor

What is a metaphor?

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The problem

Recent computational research (e.g., with LLMs) shows they struggle with abstract, analogical meaning.

Challenges of computational metaphor processing: Data scarcity and representational gaps

Contextual insensitivity

Evaluation and standardization

Theoretical fragmentation

Limits of current computational works

(e.g. compositionality)

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Aim of the work

Providing a foundation for:

Research on metaphors as **cognitive tools** *in context*

Future empirical work

Core idea: A framework that enables a more fruitful processing by treating the implicit linguistic meaning of metaphorical utterances as a multi-layered entity, *like an onion*.

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Background: Neurosymbolic computational metaphor processing

LLMs struggle with implicit, domain-specific and multimodal metaphors

Neurosymbolic approaches combine LLMs with logic

Recently developed tools like LAG (Gangemi and Nuzzolese, 2025) and METCL (Lieto et al., 2025) can be envisioned as keystones enabling representation and reasoning on complex metaphorical knowledge

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LAG: Logic-Augmented Generation

LAG treats the LLM as a
reactive KG generator

Enriches with tacit knowledge
to an extended KG under
logical constraints

reasoning with Logic Augmented Generation." arXiv preprint arXiv:2504.11190 (2025).

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METCL: Metaphor Elaboration in Typicality-based Compositional Logic

A logic-based system inspired by cognitive science insights

Generates a representation of the metaphorical meaning of a sentence by combination

Compositionality is hard for neural systems (Li et al., 2024; Mondorf et al., 2025)

Lieto, Antonio, Gian Luca Pozzato, and Stefano Zoia. "The Delta of Thought: Channeling Rivers of Commonsense Knowledge in the Sea of Metaphorical Interpretations." (2025).

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Metaphors as *speech acts*

Pragmatics and the pragmatic message: “*You’re standing on my foot.*”

Computational pragmatics: focus on the **cognitive** approach in metaphor

pragmatic interpretation, but at the cost of losing the performative dimension of utterances, which is instead well highlighted by *Speech Act Theory*.

“Metaphorical speech acts” have **i n t e n t i o n s** and **e f f e c t s**

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The layered onion-framework

Layer 1 – Information context layer

Metadata of the communicative object, as domain, provenance, and annotator metadata.

Layer 2 – Conceptual combination layer

Cognitive context. Conceptual combination (blending) between source and target domains.

Layer 3 – Pragmatic layer

Analysis of intention as an illocution (and not a mental state), and analysis of immediate psychological effects with an emotional effects evaluation. Also, pragmatic cues and contextual indicators.

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Visual example



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Visual example



ayer

Domain: “Public health”

Provenance:

Author: “NoSmokeRevolution”

Media platform: “Facebook”

Publication date: November 15, 2013

Annotations: “A gun with cigarettes as bullets.”

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Visual example

Layer 2 – Conceptual combination layer

Source: “bullets”



war
nail targets
roadblock
poker slang
...

Target: “cigarettes”
unhealthy
bad
gas station
carcinogens

...
METCL
Combination:
“cigarettes-bullets” unhealthy
bad
war
nail targets

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Visual example

Layer 3 – Pragmatic layer



Attitude: negative

Illocutionary Act: directive

Directive Kind: highly assertive

Perlocutionary Act: “stop smoking”

Perlocutionary Effect: “fear”, “concern”, “shock”

Efficacy: high (4/5)

Visual Clues: “absence of color”, “smoke”

Visual tone of voice: “dramatic”, “alarming”

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Proceeding, in practice

Dataset creation

Recruit and train annotators

Labeling according to the three layers

Neurosymbolic AI application

Ontology definition according to the three layers

KG build: METCL/LAG

Multi-dimensional evaluation

Areas of application

Education/learning support

Science communication

Legal and policy discourse

Hate speech and moderation

...

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Conclusions

If LLMs fail with metaphor, it is also because there are core issues to solve concerning *how* we think about metaphor

Pragmatics helps us to think about meaning in use and situate it Neurosymbolic pipelines can be an effective approach, provided that we consider multi-dimensional evaluation methods

Current effort to face these issues is still at its infancy.

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T h a n k y o u !



Link to the preprint

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