### Discovering Linguistic Abstraction An overview of the ABSTRACTION project

ARSTRAC

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### ABSTRACTION RESEARCH GROUP





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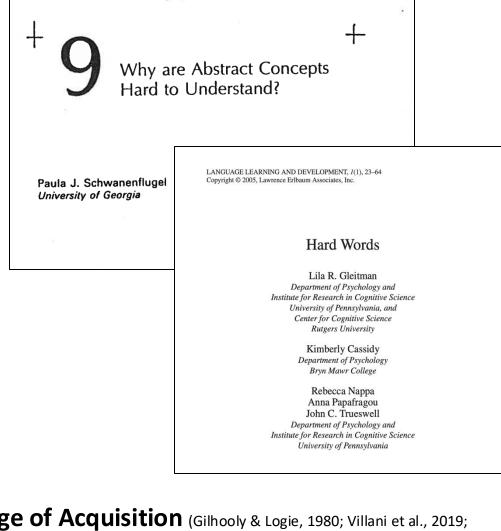
Abstraction, a hallmark of human cognition, is the ability to *pull off* meaning *from* experience

### Concreteness

- The degree of **perceptibility** of a word referent







- Later Age of Acquisition (Gilhooly & Logie, 1980; Villani et al., 2019; Bellagamba et al., 2022)
- Concreteness effect: Longer RTs and minor accuracy

(Paivio, 1991; Schwanenflugel et al., 1988; Kroll & Merves, 1985 – but see Brysbaert et al., 2016 and Kousta et al., 2011)

### Specificity

- The degree of semantic precision of a word meaning in terms of category inclusiveness.
- Hierarchical taxonomic relations between concepts(Rosch & Mervis, 1975; Bolognesi et al. 2020; Bolognesi

and Caselli 2023; Villani & Bolognesi, under review)

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#### Basic-Level Superiority in Picture Categorization

GREGORY L. MURPHY

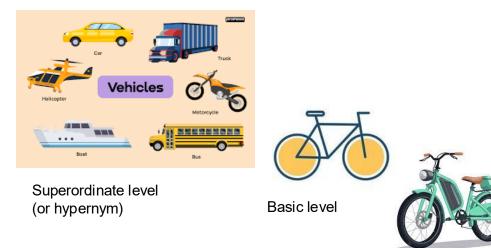
Stanford University

AND

Edward E. Smith

#### Order of Acquisition of Subordinate-, Basic-, and Superordinate-Level Categories

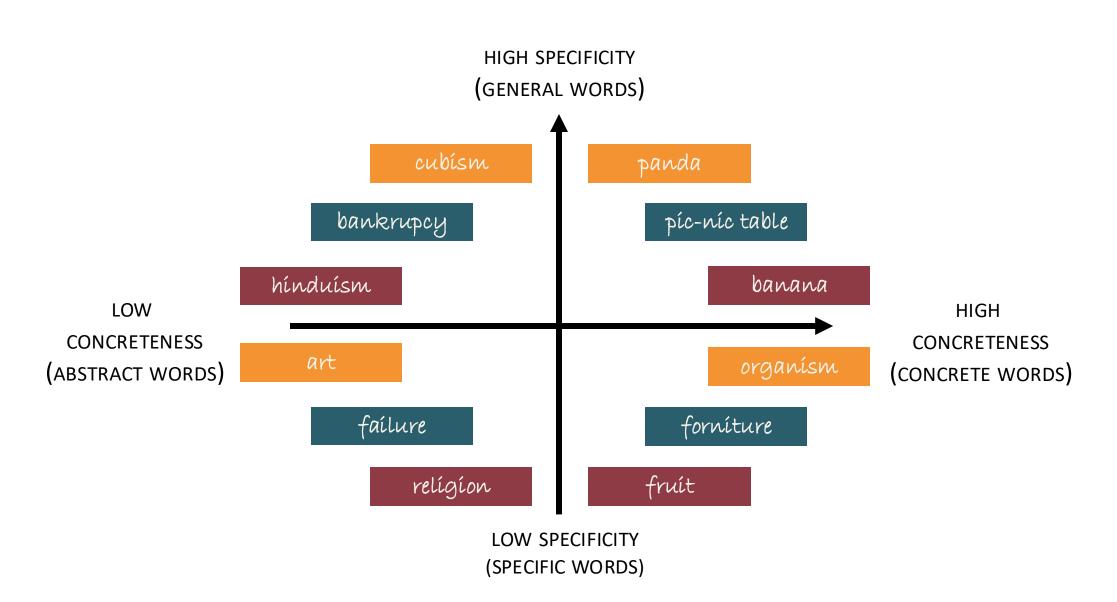
Carolyn B. Mervis and Maria A. Crisafi University of Illinois at Urbana-Champaign



Subordinate level (or hyponymy)

• Basic-level advantage effect in both words acquisition and words

processing (Rosch et al. 1976; Markman & Wisniewski, 1997; see also van Hoef et al. 2023)



Bolognesi, Burgers, & Caselli(2020) report a positive, <u>but mild correlation (r = 0.3)</u>



Abstractness ~ Concreteness norms based on speaker ratings in many languages (e.g., Brysbaer et al. 2014)



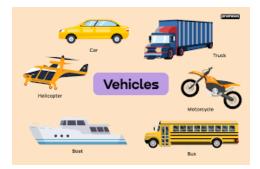
Resources for specificity remain scarce, as specificity is a relational variable (Villani & Bolognesi, under review, Elsevier Encyclopedia) 1 = VERY ABSTRACT



**5 = VERY CONCRETE** 



Is more specific or general than



### **Getting Specificity Judgments**

### **Best-Worst scaling**

**Statistical Analysis Highlights** 

- Intermediate specificity words:
  - More frequently used
  - Learned earlier by children
- More specific words:
  - Tend to carry more negative emotional valence
  - Suggest richer vocabulary for describing negative over positive nuances

In addition, Ravelli & Bolognesi (2025) used generative AI models to perform the same task and found that these models can simulate human perception of lexical specificity very well.

"Point me to the most general and the most specific word in the following group of words. "

> FORK BASIL OBJECT VEHICLE

> > 8

### **Getting Specificity Judgments**

Word Ladders is a free, educational mobile application for Android and iOS.







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Adversary challenge

Group challenge



# ABSTRACT

### ABSTRACTION

IN THOUGHT

#### ABSTRACTION

IN

TEXTS

 ABSTRACTION IN CREATIVITY

## ABSTRACTION IN THOUGHT



### **Concreteness & Specificity in Conversational Dynamics**

Lamarra, Villani et al.(2024) tested the reactions to dialogues varying words in it. <u>Study 1: Concreteness</u>

• Abstract words made expressions of uncertainty, curiosity, and social need seem more plausible.

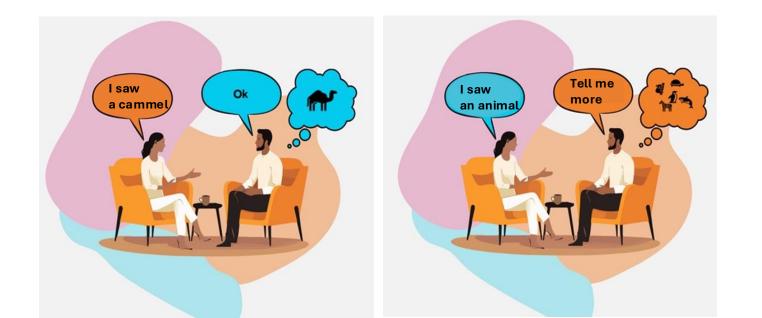
• **Concrete** words made certainty, affirmativity, and conversation closure seem more plausible.



### **Concreteness & Specificity in Conversational Dynamics**

Lamarra, Villani et al. (2025) tested the reactions to dialogues varying words in it. <u>Study 2: Specificity</u>

- **Specific** words within concrete dialogues strengthened perceptions of affirmativity and closure.
- **General** words within concrete dialogues encouraged curiosity and requests for more information.

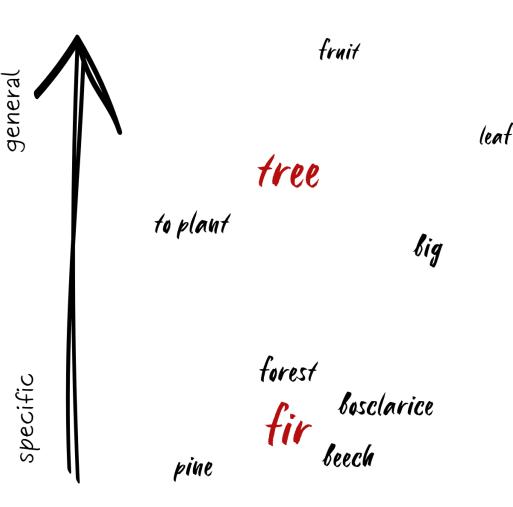


## ABSTRACTION IN TEXTS



### **Contextual variability of word use**

- Prior Findings
  - Concrete words →Used in fewer, similar contexts
  - Abstract words → Occur in a wider range of diverse contexts
- Quantitative corpus-based analyses for Italian and English (Rambelli et al., 2023,2024) reveal
  - It's not concreteness, but lexical specificity that best predicts context variability.



# ABSTRACTION

## ABSTRACTION IN CREATIVITY

### **Linguistic Creativity**

Linguistic creativity is the **ability to combine words and language structures in new ways**, generating expressions that are little or not at all documented in the language of use.

- Language is not a rigid system of rules, but an ever-evolving network of constructions. Instead of constructing each sentence from scratch, speakers borrow, reshape and extend past linguistic experiences.
- When we relate different concepts or expressions on the basis of structural similarities, we create **analogies**.

### **Creativity in LLMs**

Rambelli et al., (2024) investigated whether Large Language Models (LLMs) can interpret noun-noun compounds in a similar way to humans.

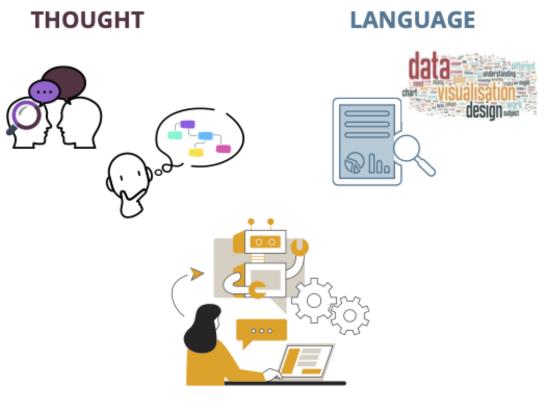


#### **avocado chair** is a chair MADE LIKE an avocado or FOR an avocado?

We found that unlike humans, **LLMs struggles to generalize** these linguistic constructions: true analogical reasoning, the essence of human creativity, remains (for now) out of its reach.

### ... and more questions are still investigated!

- What's the relation between concreteness and specificity in language processing?
- How do concreteness and specificity affect conversational dynamics?
- How does language-mediated abstraction skills unfold in linguistic development?
- Can LLMs approximate the language-mediated abstraction skills of humans?
- How are specificity and concreteness used in different text genres to achieve different communicative goals?
- How do humans vs. LLMs generalize, to interpret generic statements?



LLMs







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https://www.abstractionproject.eu/

https://site.unibo.it/abstraction/en



https://www.youtube.com/@Abstractionproj

@abstractionerc.bsky.social

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### "Abstraction"

## Latin: *pulled off from* (experience)

Through abstraction processes we:

- learn new information (e.g., Glenberg et al. 2011; Hinds et al. 2001; Mandler, McDonough 1998; McGinnis, Zelinski 2000)
- form judgments (e.g., Henderson et al. 2006; Klein et al. 1992; Ledgerwood et al. 2010; Wakslak 2012)
- regulate behavior (e.g., Freitas et al. 2004; Fujita et al. 2006; Schmeichel et al. 2011)
- create and appreciate art (Witkin 1983, Hackett 2016).