

# The interplay between cognitive and communicative pressures in the lexicon

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Invited by the Language, Cognition, and Computation (LCC) group  
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Universitat  
Pompeu Fabra  
Barcelona



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- ▶ Thomas Brochhagen
- ▶ Raquel Fernández
- ▶ Eleonora Gualdoni
- ▶ Yang Xu

# Language



cognition



communication

word meaning



word use

## Part 1/3: How language changes

# Euphemisms

toilet Austin, Texas, US, 2012 restroom

“toilet” ⇐ “That toilet is stinky.”

- ▶ early: bog-house, privy-house
- ▶ around 18th cent.: house-of-office
- ▶ 19th cent.: toilet, lavatory
- ▶ 20th cent.: loo (UK), bathroom, restroom (US)
- ▶ (not exhaustive)

(Source: Wikipedia and Online Etymology Dictionary)

Yet another one!

Niagara Falls, ON, Canada, August 1 2022



# Words change meaning over time

## ► toilet

- ▶ 16c. “cover or bag for clothes”, from French *toilette* “a cloth; a bag for clothes”, diminutive of *toile* “cloth, net”;
- ▶ 17-18c. “a fine cloth cover on the dressing table for the articles spread upon it”  
⇒ “the articles, collectively, used in dressing” (mirror, bottles, brushes, combs, etc.)
- ...
- ▶ 19c. “a dressing room”, especially one with a lavatory attached;
- ▶ 20c. current meaning

Source: Online Etymological Dictionary

How does change happen?

# How language changes: through the magnifying glass

Del Tredici, Fernández, Boleda NAACL 2019

156 | **Van Dijk to 8 year-old child: "You support Everton? Tough, isn't it? Must be very tough."**

twitter.com/Sennes... ↗

12 Comments Share Save Hide Report 98% Upvoted

What are your thoughts? Log in or Sign up

SORT BY **BEST**

InvalidateMind 140 points · 3 hours ago

The kid is a role model to show to glory hunters everywhere. He's loyal to his club, surrounded by LFC staff, fans and van Dijk

Carloz11 51 points · 2 hours ago

YNWA, but props to that kid. Look at his body language lol. Might swing at Virgil.

# How language changes: through the magnifying glass

*Damn, after loosing the **F5** key on my keyboard ...*

*He is so close, **F5** tapping is so intense now!*

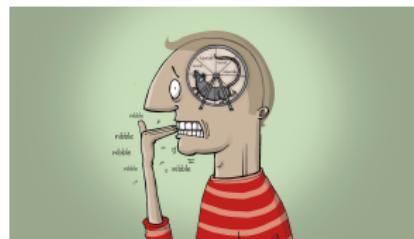
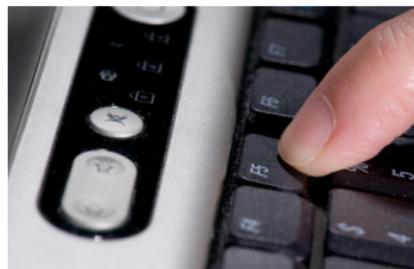
*Don't think about it too much, man. Just **F5**!*

*I slept and just woke up and thought it was **F5 time***

*This was a happy **F5**!*

# How does change happen?

one interaction at a time

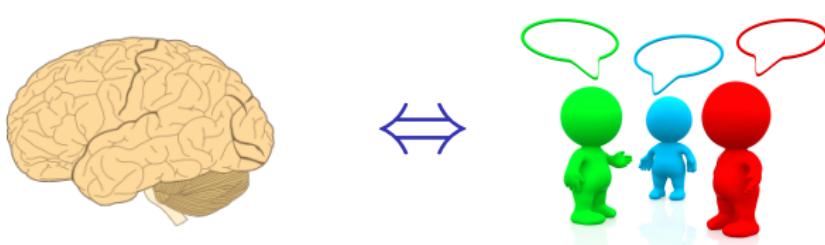


cognition

communication

## Part 2/3: How language is as a system

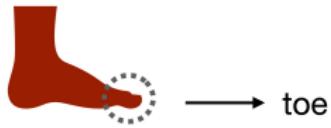
conflicting demands between cognitive and communicative needs shape language



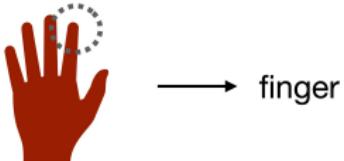
- ▶ How do languages structure meanings in their lexicons?
  - ▶ When do languages use the same word for different meanings?

# When do languages use the same word for different meanings?

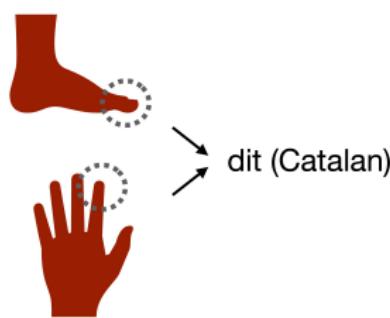
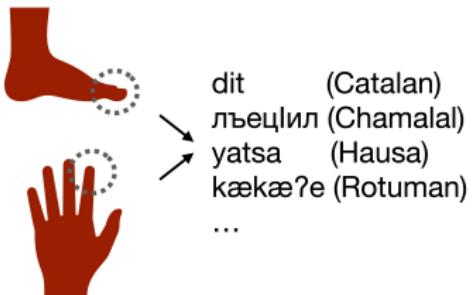
Brochhagen and Boleda *Cognition* 2022



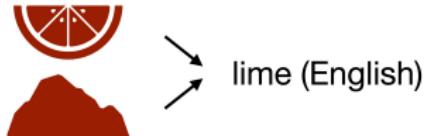
→ toe



→ finger



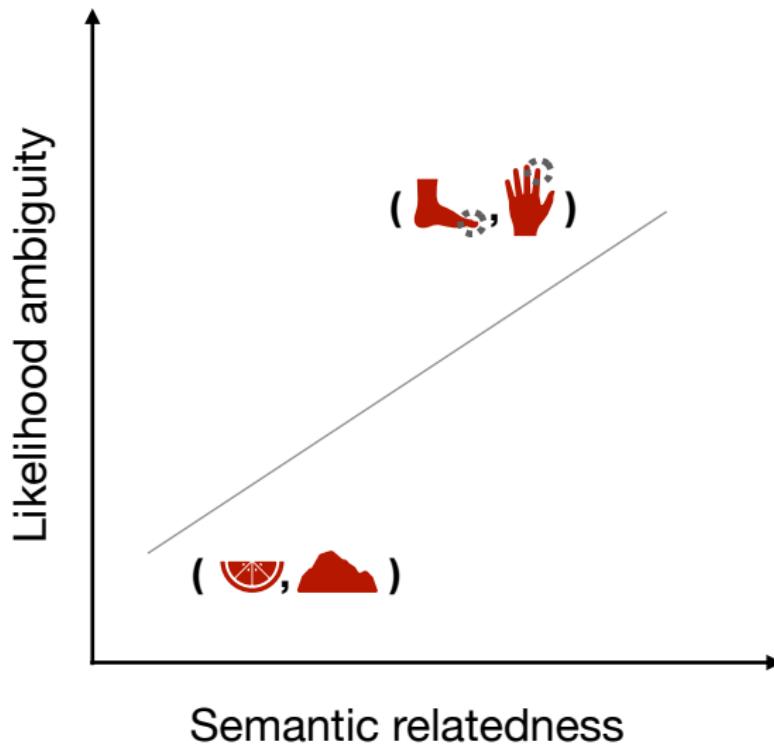
→ dit (Catalan)

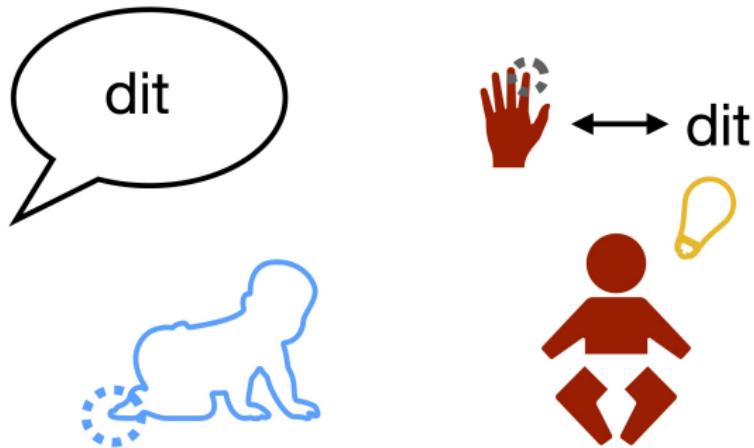


→ lime (English)

# Previous work

Xu et al. *Cognition* 2020





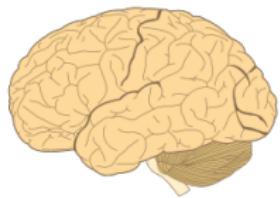
lime



lime

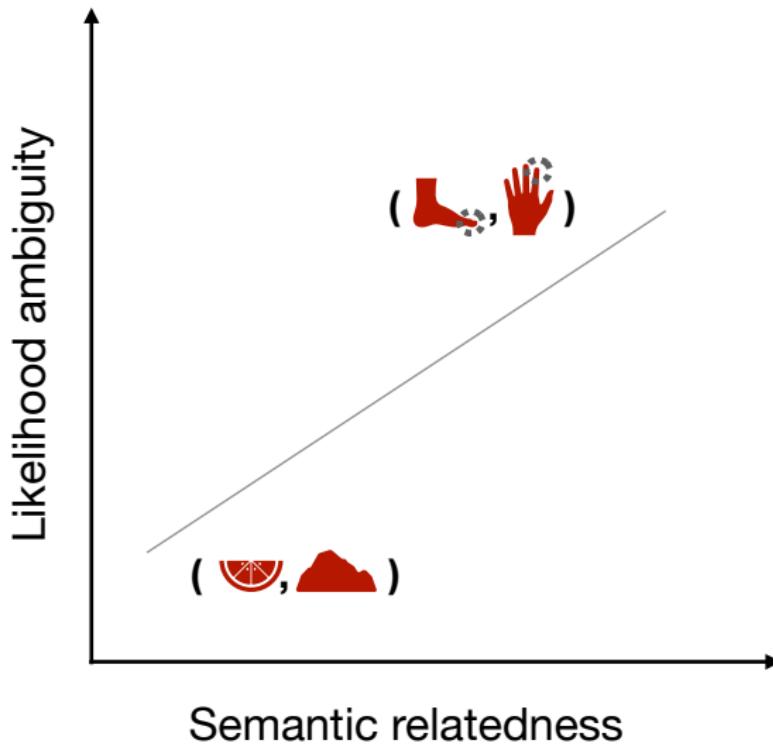


cognitive system

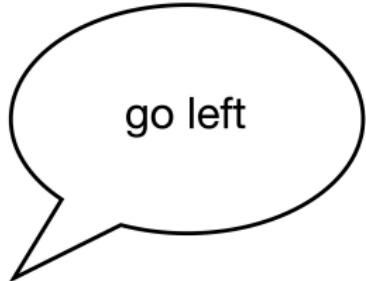
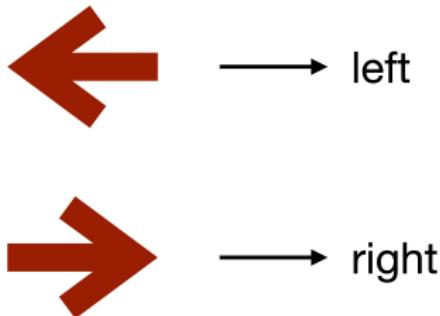


language: simple

Wait...



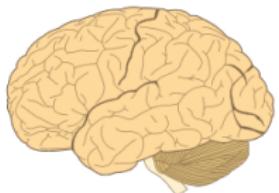
Too related?



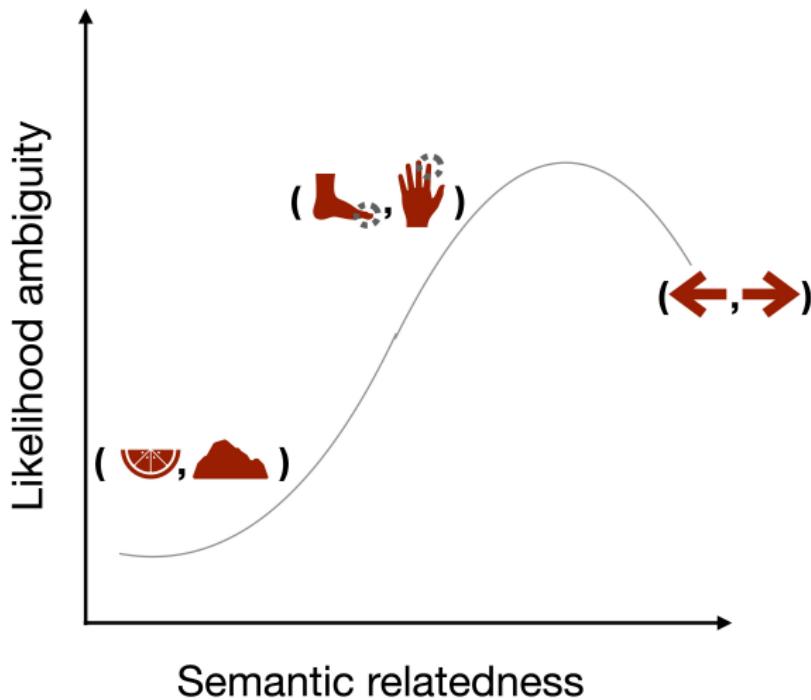
communication



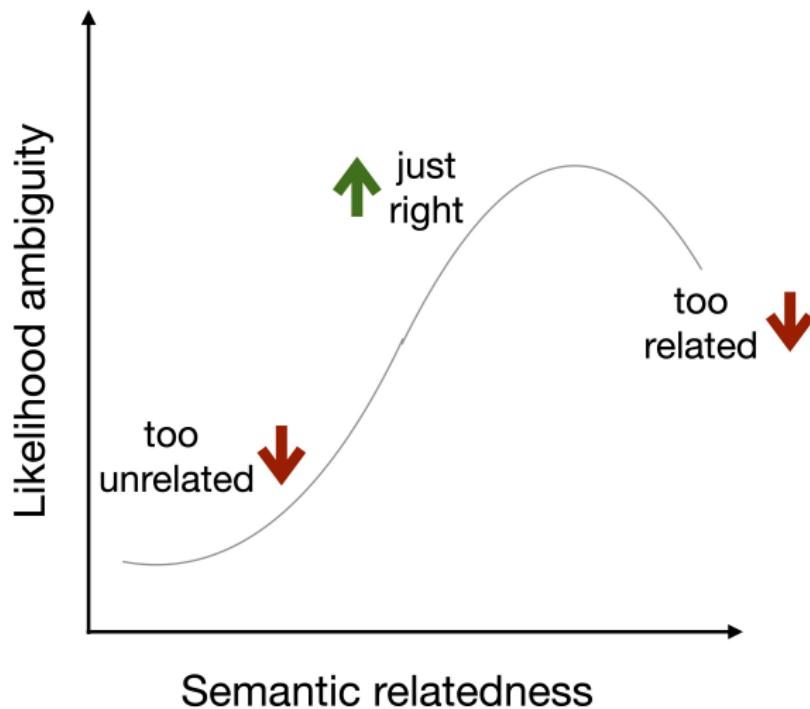
language: complex



## Prediction



# Goldilocks Principle

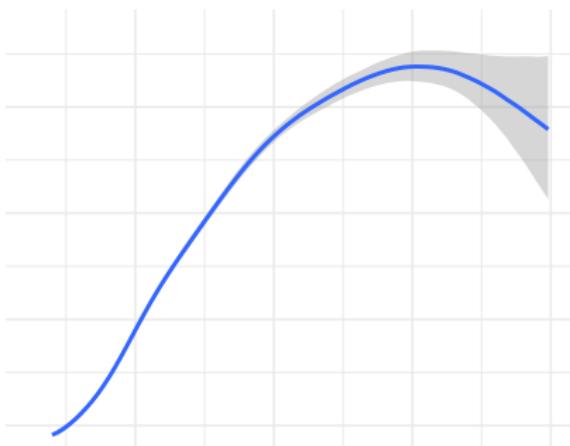
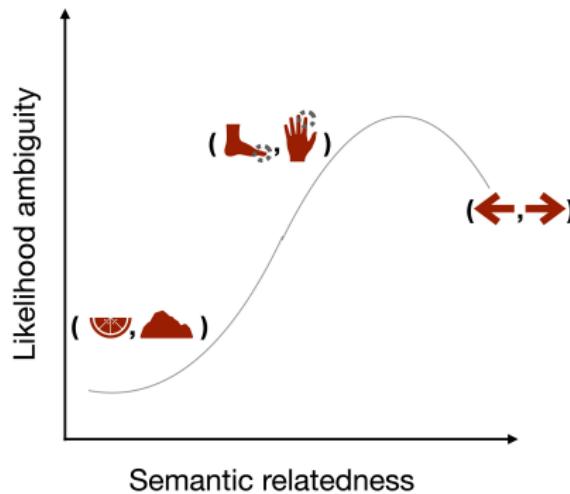


# Empirical test

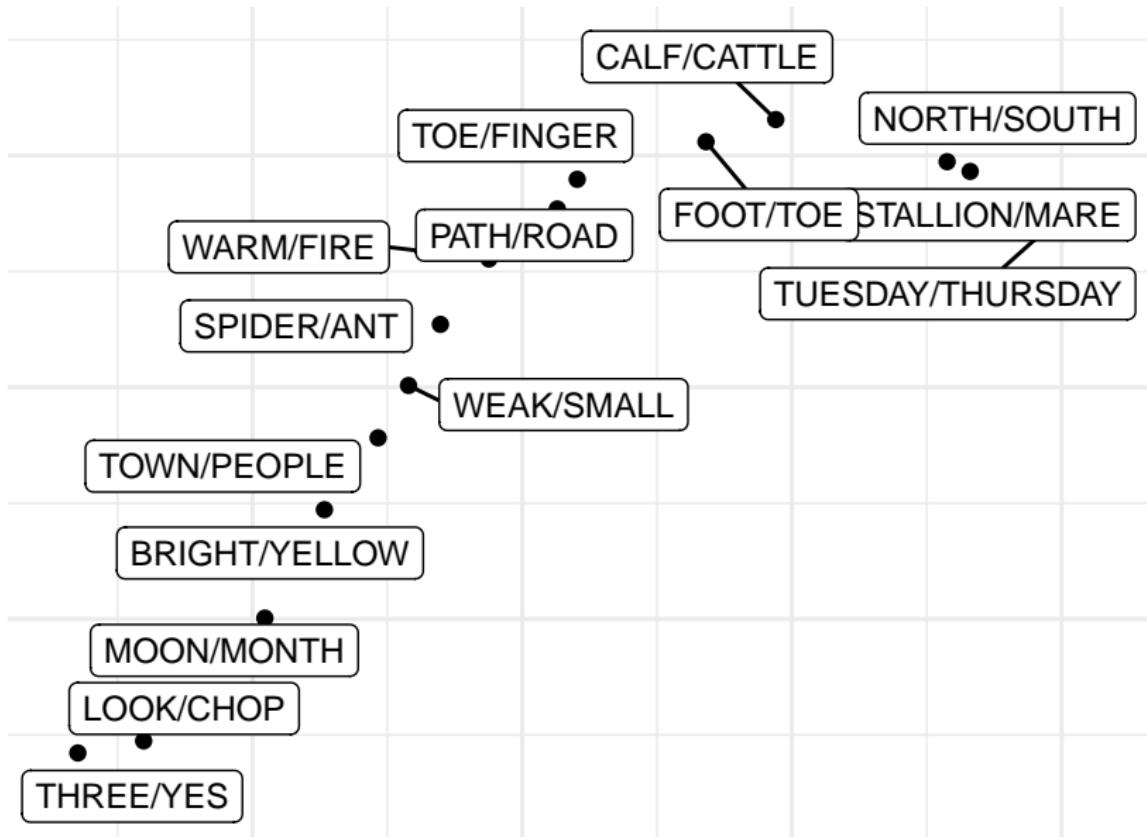
- ▶ over 3,000 language varieties
- ▶ over 2,900 concepts

Variety		Family	Form in source	Gloss in source
	<input type="button" value="Search"/>	<input type="button" value="Search"/>	<input type="button" value="Search"/>	<input type="button" value="Search"/>
Sirionó		Tupian	eo	finger
Wayampi		Tupian	pu?ã	finger
Kaingáng		Nuclear-Macro-Je	nĩ̄ε φεγ	finger
Karajá		Nuclear-Macro-Je	debo	finger
Trumai		Trumai	kat=kel	finger

# Empirical test

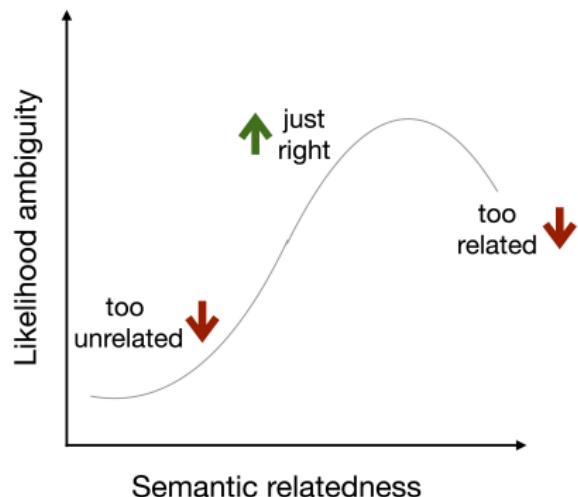


# Examples

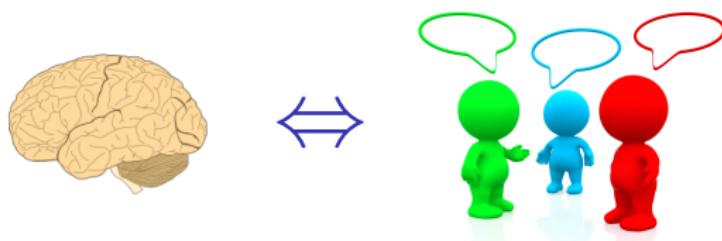


## When do languages use the same word for different meanings?

- ▶ Based on large-scale cross-linguistic data:
  - ▶ when the meanings are related enough to foster cognitive economy...
  - ▶ and not too confusable in actual language use



conflicting demands between cognitive and communicative needs shape the lexicon

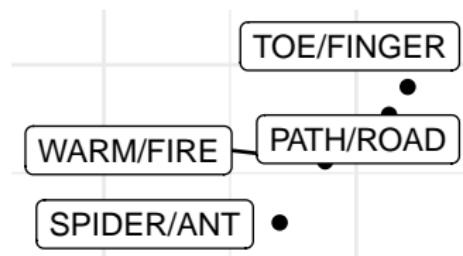


## Part 3/3: Universal principles?

# Lexical ambiguity in language acquisition

cross-linguistic ambiguity

⇒ language **EVOLUTION**,  
long time scale



# Children overextension



Fernanda Ferreira  
@fernandaedi

...

The toddler nephew has decided  
that if orange is called orange  
then yellow is called banana.

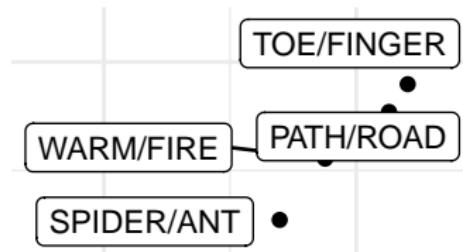
[Traduci il Tweet](#)

⇒ language **DEVELOPMENT**,  
short time scale

# Lexical ambiguity in language acquisition

cross-linguistic ambiguity

⇒ language **evolution**,  
long time scale



children

⇒ language **development**,  
short time scale

- ▶ **apple**: artichoke, rubber ball, balloon, banana, biscuit, cherry, egg, ball lamp, ...
- ▶ **comb**: centipede



are there shared principles?

## Method

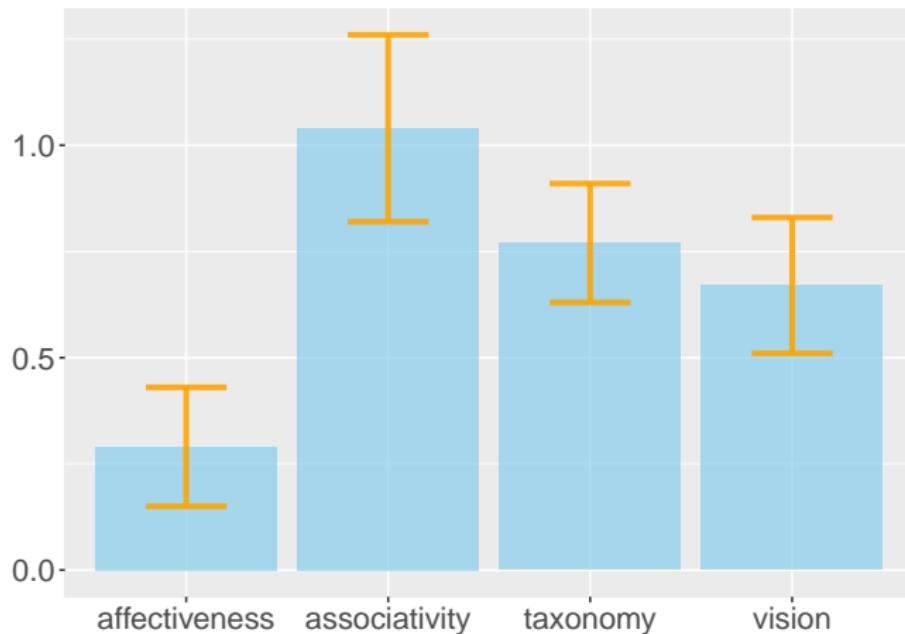
- ▶ build a statistical model that predicts lexical ambiguity across languages
  - ▶ e.g. how likely are meanings TOE, FINGER to cohabit in a word in Catalan?
- ▶ apply it to children overextension data (English)
  - ▶ e.g. how likely is an English child to call an artichoke “apple”?
- ▶ and viceversa

## Predictors

- ▶ associativity: bus - loud vehicle noises
- ▶ visual similarity: apple - balloon
- ▶ taxonomic similarity: apple - banana
- ▶ affective similarity: dada - mom

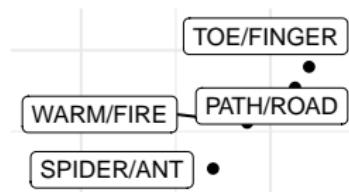
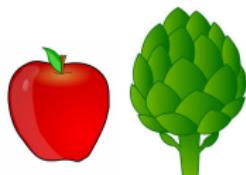
# Children overextension: model coefficients

how likely is a child to call an artichoke “apple”?



## Cross-prediction: Results

	→ children	→ cross-linguistic
children	81	80
cross-linguistic	73	75

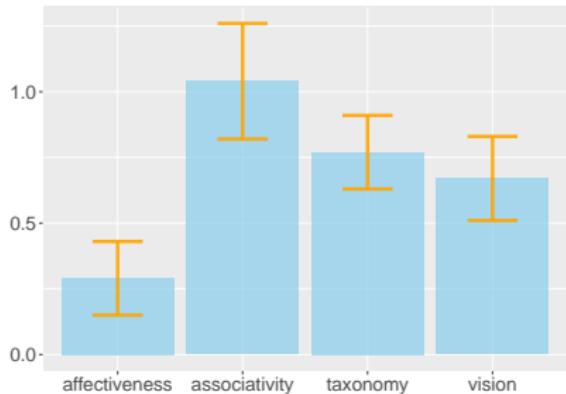


## Examples

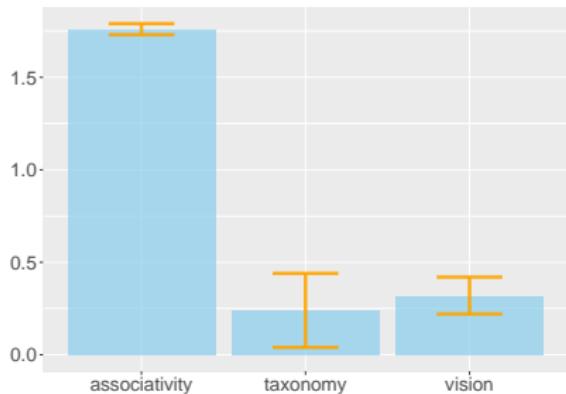
- ▶ apple - fruit
- ▶ ball - circle
- ▶ cheese - butter
- ▶ wheel - wagon
- ▶ banana - leaf
- ▶ flower - mother
- ▶ fruit - small
- ▶ light - lamp ⇒ Catalan “llum”; Spanish “luz/lámpara”

# Development vs. evolution: differences

development (children)



evolution (language lexicons)



# Universal knowledge in lexical ambiguity

word meaning ambiguity

- ▶ in natural languages: stable semantic structures as products of language **evolution**
- ▶ in children: fleeting byproducts of early language **development**



**ontogeny ~ phylogeny**

## Back to the role of cognition and communication

cognition



communication



APPLE

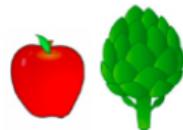
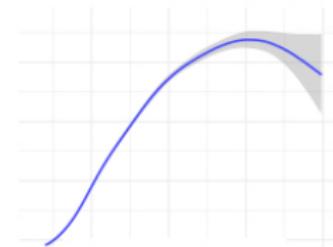


FRUIT

Wrapping up

## Word meaning - word use

“toilet” ⇐ “That toilet is stinky.”



# Language



cognition



communication

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Computational  
Linguistics  
and Linguistic  
Theory