Multilingual Modelling with Wordnets: Metonymy Travels, Metaphor Wanders

Francis **Bond**
Rowan Hall **Maudslay** and many, many more

Asian Studies & Sinofon Center
General Linguistics

Palacký University, Olomouc, Czechia

<bond@ieee.org>

University of Ljubljana, April 2026

Faculty of Arts

Outline

Faculty of Arts

Roadmap

Faculty of Arts

Metaphor and Metonymy

- Metaphor and Metonymy are two fundamental tropes (figures of speech)
- Both play crucial roles in the way we understand and use language
- **Metaphor** involves understanding one concept in terms of another, often unrelated, concept.
  - *This horse has a chestnut on its leg* “a small horny bump”
  - Metaphors create new concepts in the target domain by mapping elements from the source domain
- They are crucial in understanding novel uses of words
- **Metonymy** involves the substitution of one term for another to which it is closely related
  - *I ate a chestnut*
  - *I pruned the chestnut [tree]*
  - *This table is made from chestnut [wood]*
  - Metonymy works by contiguity or association between concepts, usually by some shared attribute, or by a part-whole relation

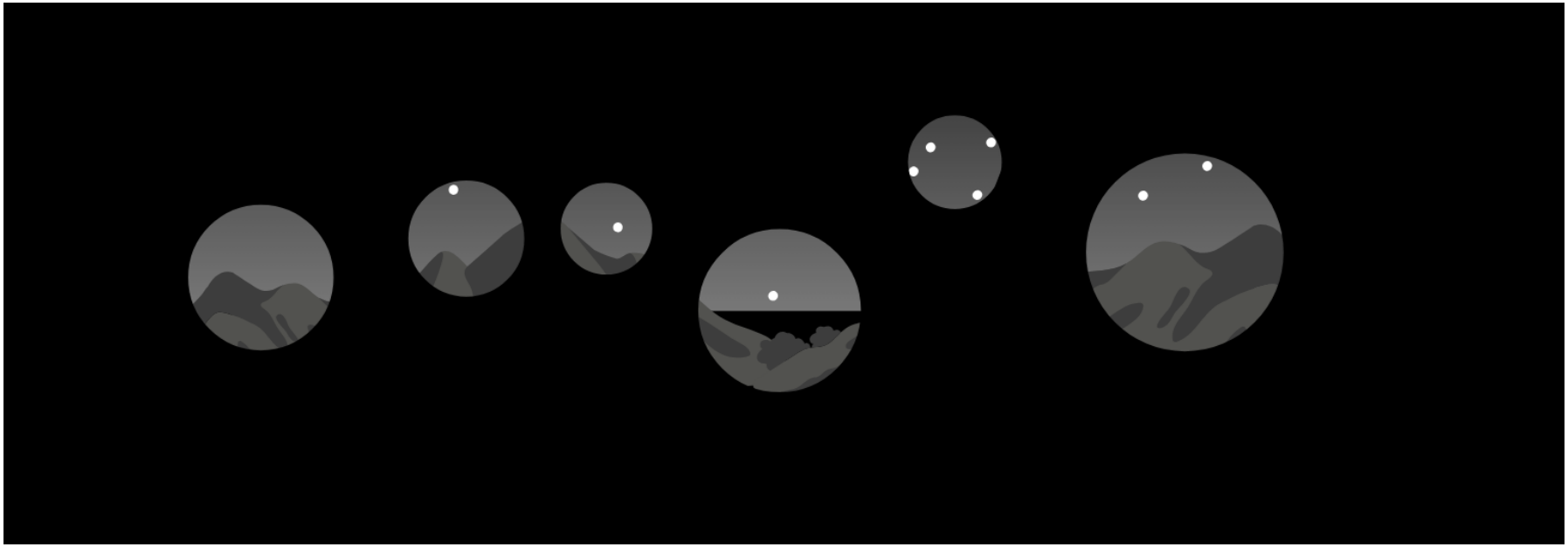
Faculty of Arts

The state-of-the art

- Conceptual Metaphor research very wide spread (cognitive, computational, therapeutic, political)
  - A lot of fantastic research!
- No broad coverage multilingual inventory of metaphors
  - MetaNet — long-running but mainly English (some Spanish and Chinese, far from comprehensive)
  - MetaphorShare — new (2025) initiative to bring together resources, but most with only hundreds or thousand of examples.
- No broad coverage multilingual corpora of instances
  - MIPVU is the largest (mainly English, some work in other languages)
- No broad coverage multilingual metaphor interpretation tools
  - Some tools for identification
  - Some tools for paraphrasing, but biased toward English (LLMs)

Faculty of Arts

SoA: scattered fragments of the metaphor landscape



Faculty of Arts

We are trying a different approach

- Exploit existing multilingual resources (wordnets and sense-annotated corpora)
- ChainNet links word senses by metaphor — for most nouns in the English wordnet
- Use ChainNet to study metaphor over a (more) complete vocabulary
  - Link lexical to conceptual metaphors
  - Find unknown conceptual metaphors (unlinked lexical metaphors)!
  - **Finish with a much more complete understanding**
  - Use wordnet sense tagged corpora to investigate attested uses
  - **Finish with a grounded, quantitative understanding**

Faculty of Arts

Roadmap

Faculty of Arts

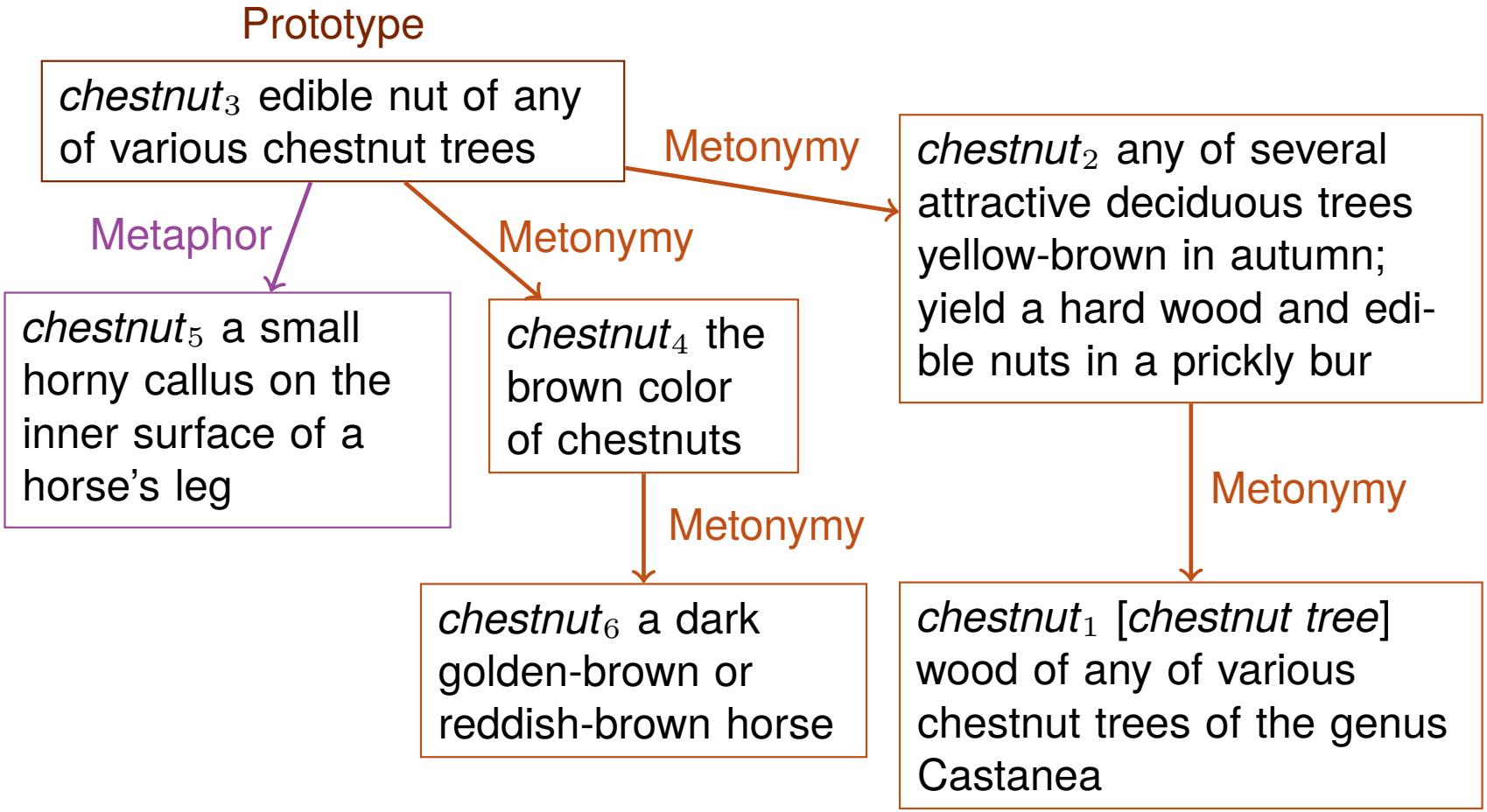
ChainNet

- ChainNet is an attempt to comprehensively model these tropes (Maudslay et al., 2024; Bond and Maudslay, 2025)
  - All nouns (word + synset combinations) in the Princeton Wordnet 3.0 (Fellbaum, 1998) with three or more senses* were annotated
  - Every sense linked to another sense, or treated as a homonym (unrelated)
    - 7,500 metaphor pairs
    - 6,116 metonymy pairs
  - Most annotated by 1 annotator, some by 2 annotators
    - Inter-annotator agreement 70% (88% for same prototype)
    - Intra-annotator agreement 81% (92% for same prototype)
  - Originally grew out of work in determining homonyms — which senses of a word are related

* almost, and some with two senses. All should eventually be annotated

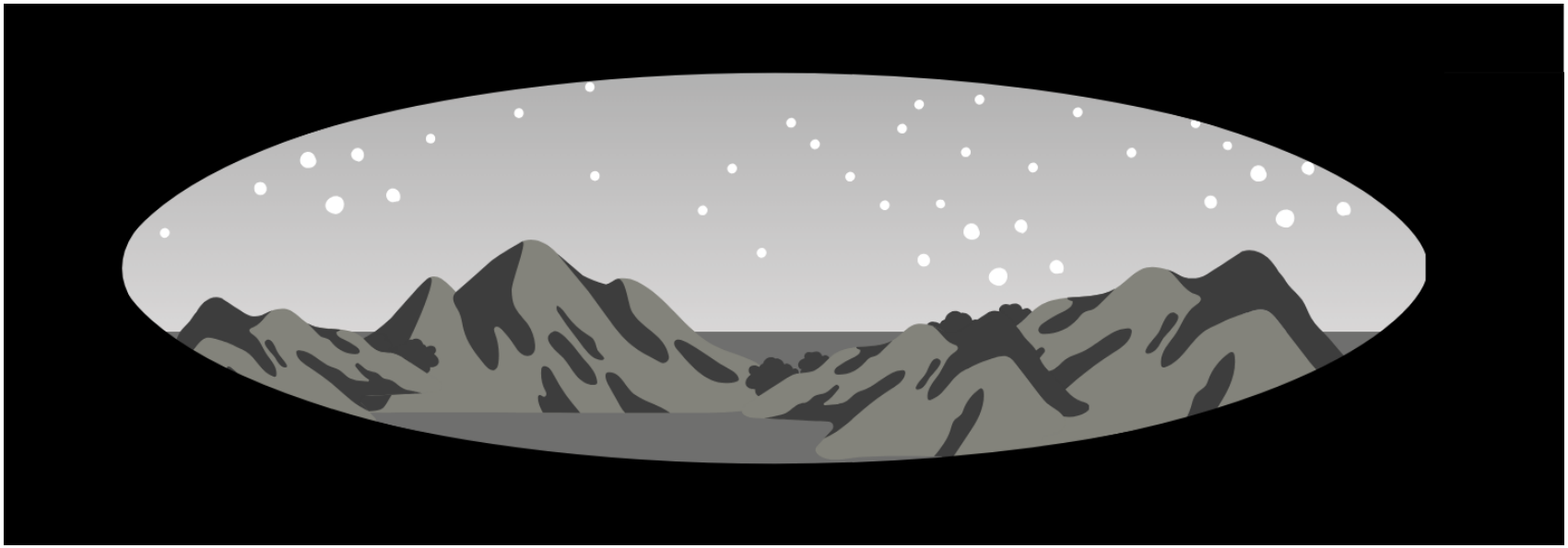
Faculty of Arts

chestnut



Faculty of Arts

Metaphor viewed through the lexicon: a broader view



Faculty of Arts

How we proceed

- For every word with more than two senses
  - examine all pairs (in wordnet)
  - determine if they are linked by metaphor or metonymy, or not at all

darkness $_1$ — absence of light or illumination
darkness $_2$ — an unilluminated area “he moved off into the darkness”
darkness $_3$ — absence of moral or spiritual values “the powers of darkness”
darkness $_4$ — an unenlightened state “he was in the dark concerning their intentions” “his lectures dispelled the darkness”

---

darkness $_1 \rightarrow$ ***darkness*** $_2$ (metonymy)
darkness $_1 \rightarrow$ ***darkness*** $_3$ (metaphor)
darkness $_1 \rightarrow$ ***darkness*** $_4$ (metaphor)

Exploit wordnet for a richer view

- Once we have senses, we can look at supersenses

darkness $_1$ (STATE) $\rightarrow$ ***darkness*** $_3$ (STATE)
darkness $_1$ (STATE) $\rightarrow$ ***darkness*** $_4$ (COGNITION)

- Or indeed any hypernym

darkness $_1$ (illumination|state|attribute|TOP) $\rightarrow$
darkness $_3$ (wickedness|condition|state|attribute|TOP)
darkness $_1$ (illumination|state|attribute|TOP)) $\rightarrow$
darkness $_4$ (unenlightenment|ignorance|knowledge|…|T.)

- We will use these to establish Conceptual Metaphor Labels

darkness $_1$ $\rightarrow$ ***darkness*** $_3$ = GOODNESS IS LIGHT
darkness $_1$ $\rightarrow$ ***darkness*** $_4$ = UNDERSTANDING IS LIGHT

We want to group metaphors

- UNDERSTANDING IS LIGHT
  - *That talk left us in the dark*
  - *I have seen the light*
  - *That was illuminating*
- GOODNESS IS LIGHT
  - *Come away from the dark side*
  - *Those are dark deeds*
  - *They were the light of my life*

Faculty of Arts

Link to Sense-tagged corpora

Finally, we combine this with examples from sense annotated corpora, giving frequencies of metaphorical and non-metaphorical uses.

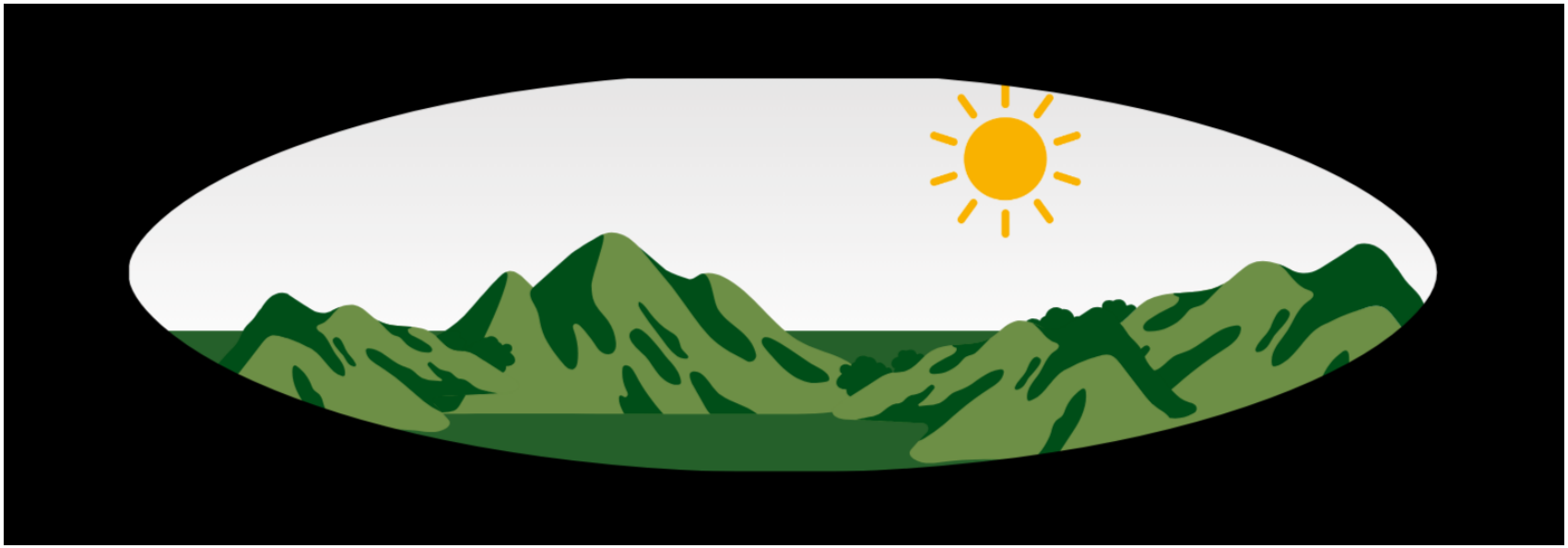
Examples from *The Adventure of the Speckled Band* (English)

- *Oh, sir, do you not think that you could help me, too, and at least throw a little light through the dense* ***darkness*** $_4$ *which surrounds me?*
- *"Do you know, Watson," said Holmes as we sat together in the gathering* ***darkness*** $_1$*, "I have really some scruples as to taking you to-night.*
- *Then he turned down the lamp , and we were left in* ***darkness*** $_1$*.*

We have at least one story manually annotated for Bulgarian, English, Mandarin Chinese, Indonesian, Italian, Japanese and Polish, and automatically for Dutch and German.

Faculty of Arts

Metaphor linked to wordnet and corpora: a richer view



Faculty of Arts

Roadmap

Faculty of Arts

Differences Between Metaphors and Metonyms

We can use the wordnet graph to compare the two

- For all trope pairs we measure the path distance between the source and target
- We measure the depth in the hierarchy (distance from root)
- We measure the inclusiveness (low is inclusive, high is specific) $\approx$ abstractness
- We measure the sentiment (Bond and Choo, 2022)
- We also look at the distribution of the domains (González et al., 2012)

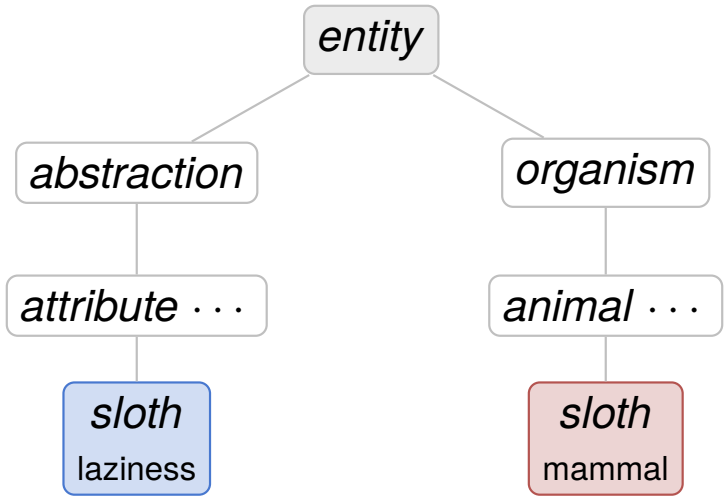
These are new results

Faculty of Arts

Path Distance: Metaphor bridges distant concepts

Path distance = $\dfrac{1}{1 + \text{steps in WordNet graph}}$

Metaphor: *sloth* (animal → laziness)

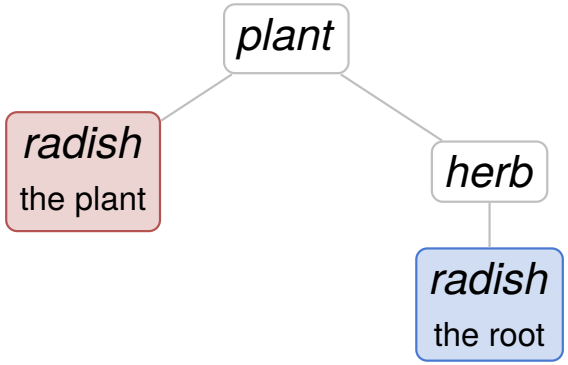


≈20 steps through *entity* ⇒ path dist. = 0.05

Faculty of Arts

Path Distance: Metonymy stays close

Metonym: *radish* (root → plant)



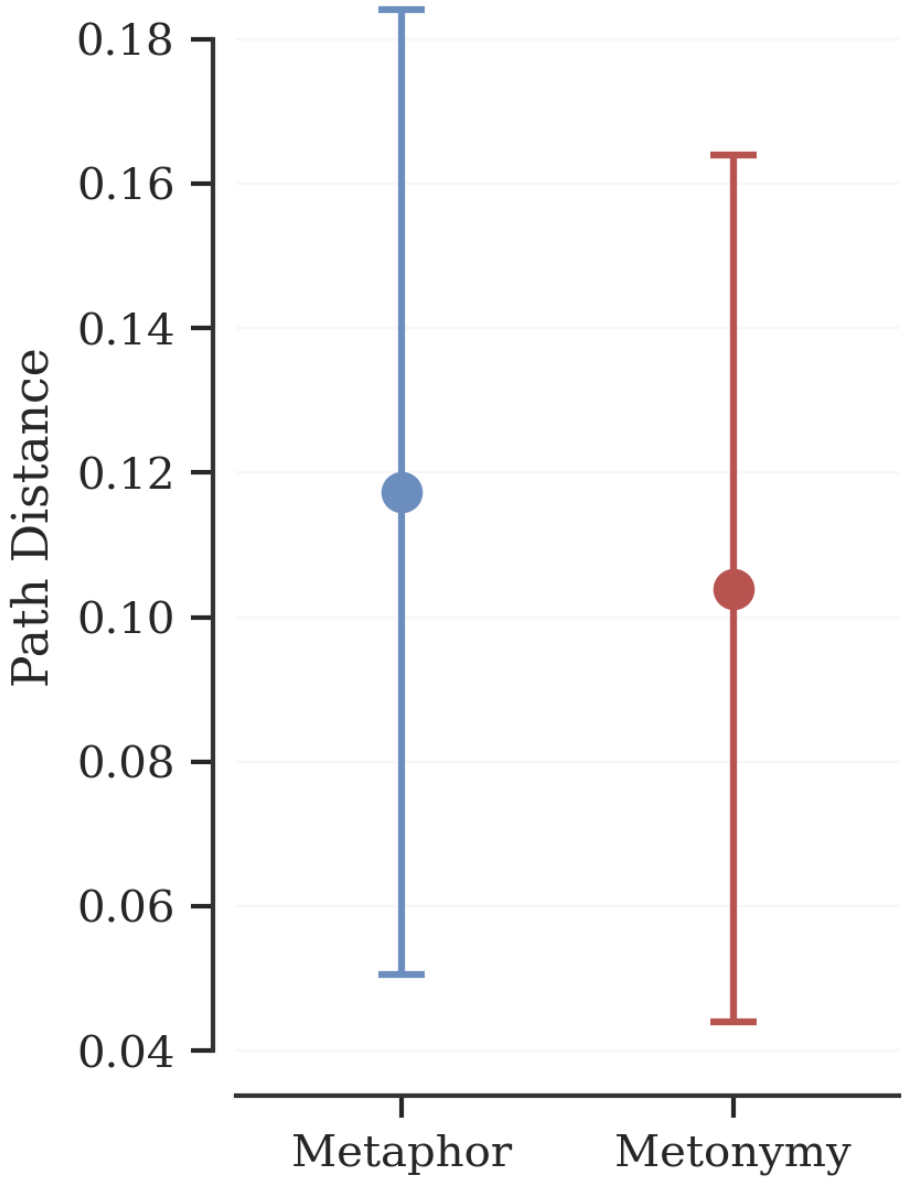
2 steps ⇒ path dist. $= 0.33$

Pair	Path dist.
same synset	1.00
direct parent/child	0.50
radish root ↔ plant	0.33
sloth mammal ↔ laziness	0.05

Prediction: metaphors bridge more distant concepts

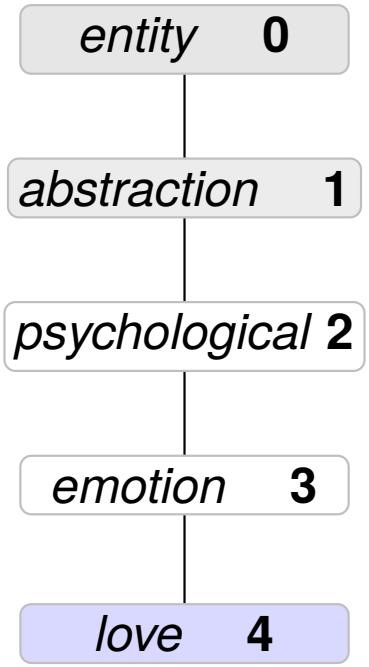
Faculty of Arts

Path Distance Comparison



Faculty of Arts

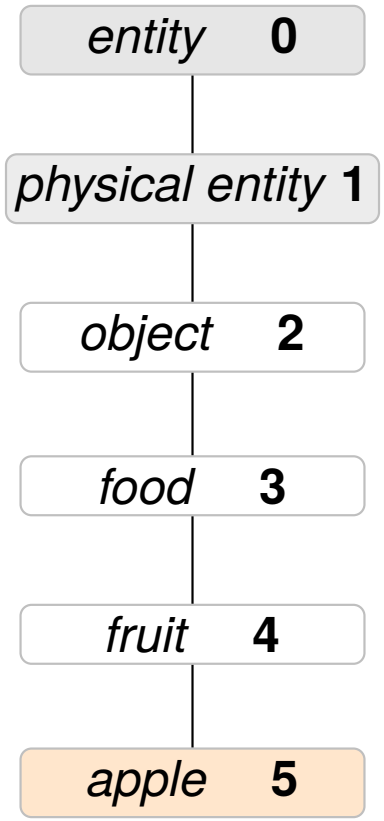
Depth: Shallow = Abstract



- **Shallow** (low depth) ≈ general/abstract concept
- We use `synset.min_depth()` — shortest path to root

Faculty of Arts

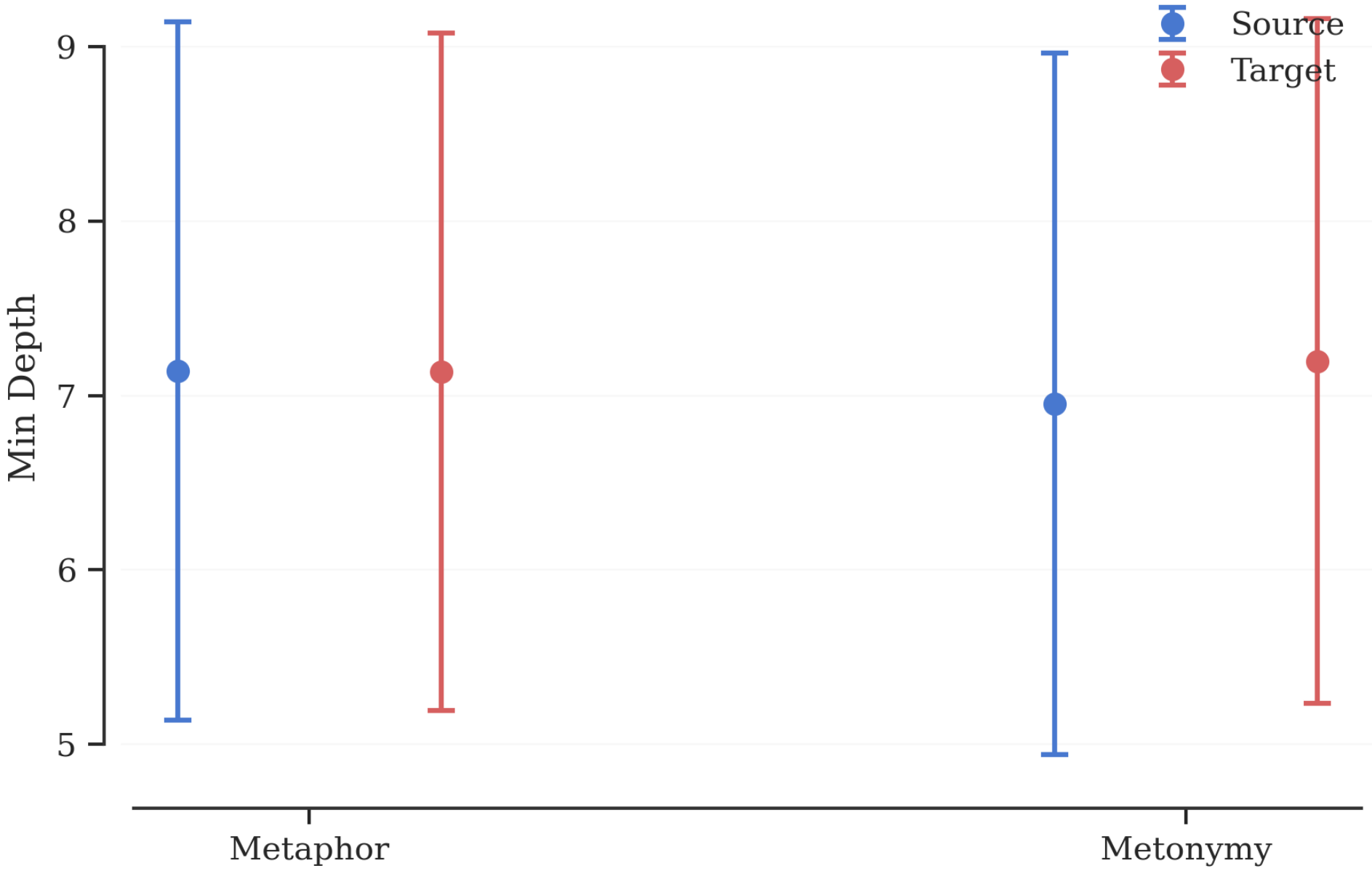
Depth: Deep = Concrete



- **Deep** (high depth) ≈ specific/concrete concept
- **Prediction**: metaphor source is more concrete (deeper) than target

Faculty of Arts

Depth in Hierarchy



Inclusiveness: How Much of the Conceptual Space Does It Cover?

If concept c has n descendants (direct + indirect) among N total noun synsets:

$$\text{inclusiveness}(c) = -\log\left(\frac{n+1}{N}\right)$$

Concept	Desc. n	Incl.
entity (root)	82,114	≈ 0.0
animal	$\approx$8,000	≈ 2.3
dog	$\approx$60	≈ 7.0
poodle (leaf)	0	≈ 11.3

$N = 82{,}115$ noun synsets in `omw-en:1.4`

Faculty of Arts

Inclusiveness: General vs Specific

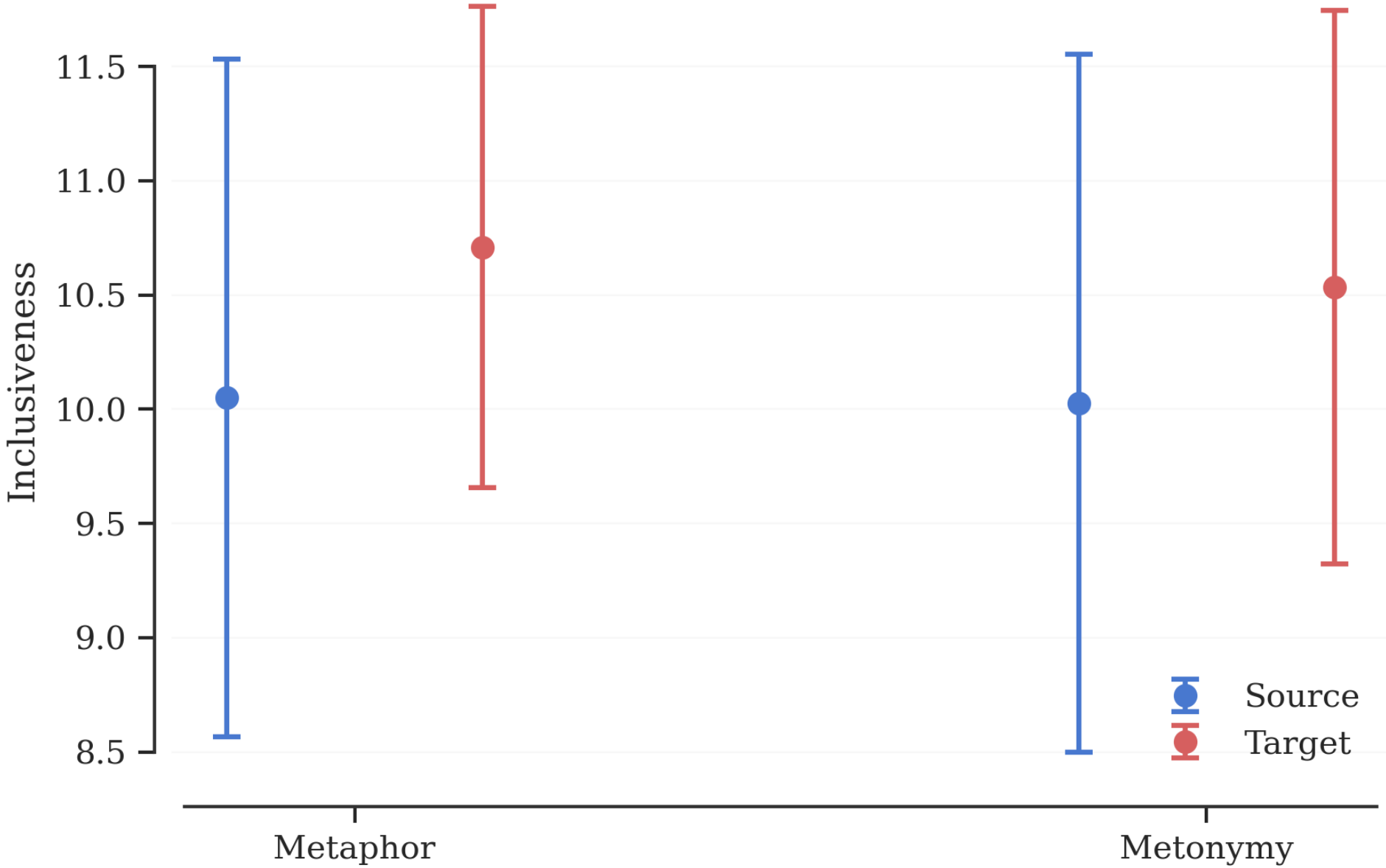
Low value (≈ 0) = very *general* concept
High value (≈ 11) = very *specific* concept

Finer-grained than simple depth: two concepts at the same depth can have very different numbers of descendants.

Prediction: tropes map *from* inclusive (general) sources *to* specific targets

Faculty of Arts

Inclusiveness (Low is general — High is specific)



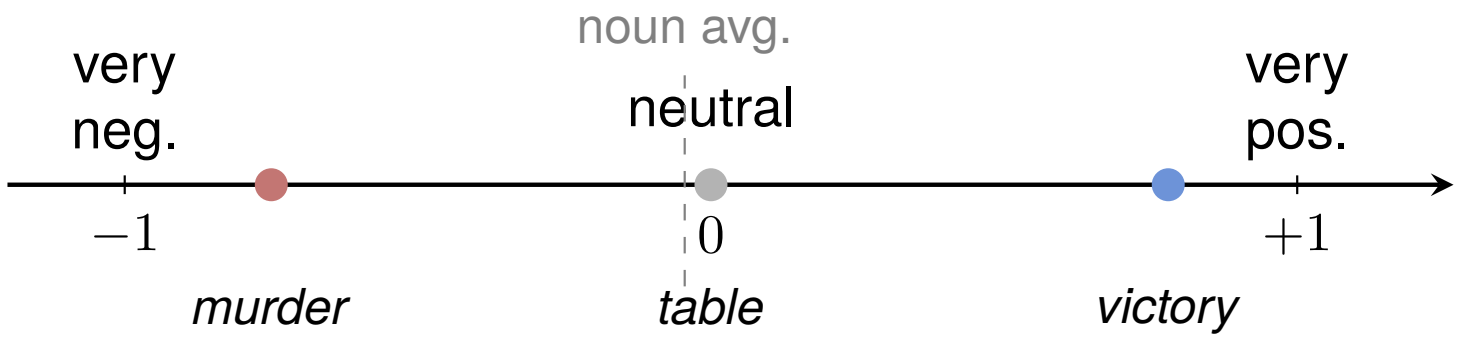
Sentiment: Is the Concept Positive or Negative?

From Bond and Choo (2022): a sense-level lexicon built by combining hand-crafted lexicons and a sense-tagged corpus, then propagating scores across the WordNet graph.

Sense	Score
love (feeling)	$+0.52$
victory (success)	$+0.38$
table (furniture)	0.00
prison (building)	-0.31
murder (killing)	-0.75

Baseline: mean score of all single-word nouns $= -0.045$
(slight negativity bias in the lexicon)

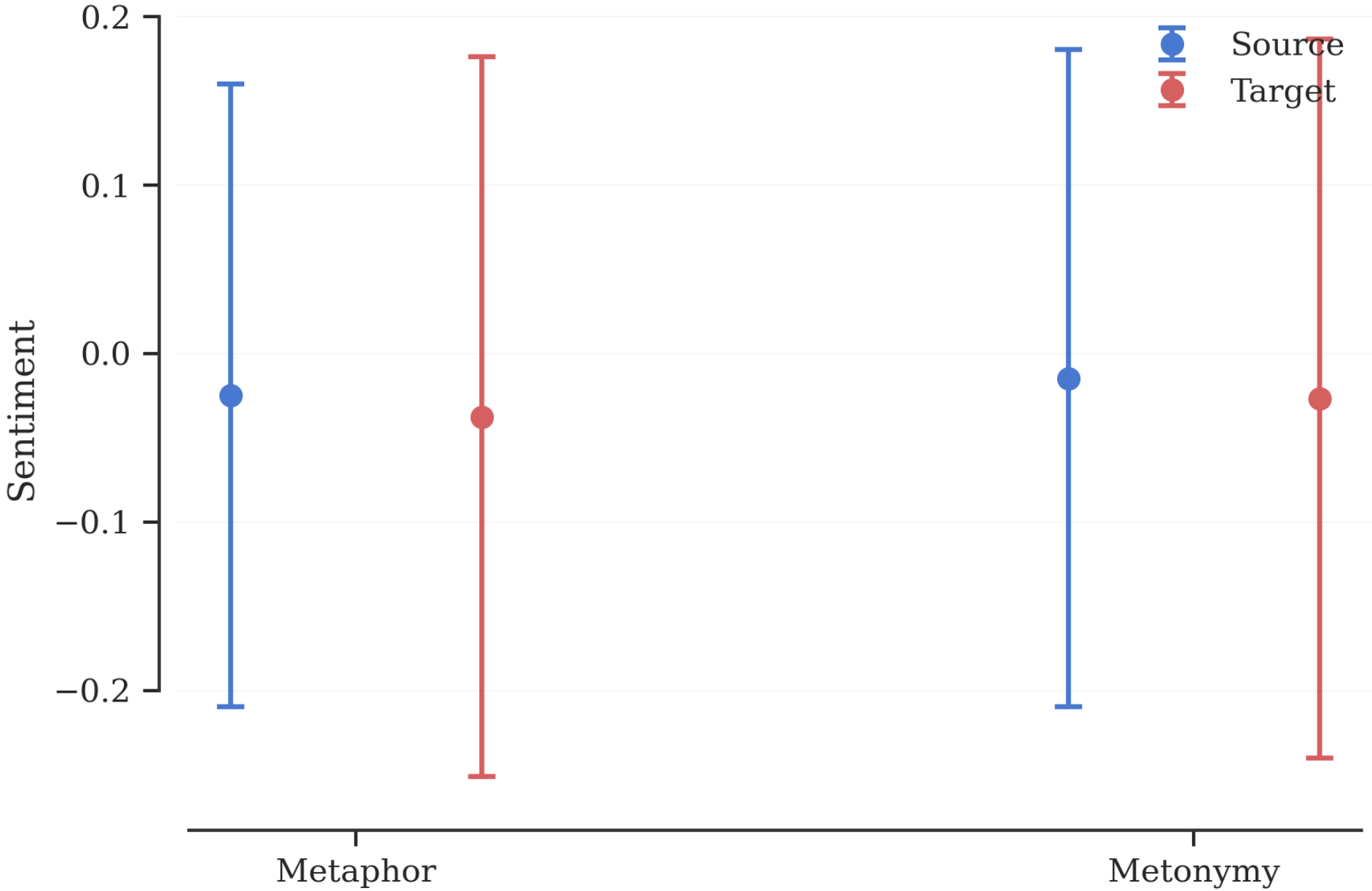
Sentiment: Scale and Prediction



Coverage: 68% of source senses, 52% of target senses annotated.

Prediction: tropes may prefer more neutral/positive source concepts

Sentiment (-1.0 to +1.0)



Domains: Two Classification Systems

WordNet topics (lexicographer files)

45 broad editorial labels assigned during WordNet construction (e.g. NOUN.ANIMAL, NOUN.ARTIFACT, NOUN.COGNITION).
Designed to organise lexicographic work — *not* cognitive conceptual domains.

eXtended WordNet Domains (González et al., 2012)

170 subject-domain labels from the Dewey Decimal Classification (e.g. `gastronomy`, `medicine`, `sport`, `animals`).
Propagated to all 82k noun synsets by a graph-based algorithm (UKB) using WordNet relations + gloss links.

Each synset is assigned its **highest-scoring** domain.

Faculty of Arts

Domains: Do Metaphors Cross Domains?

Example:

I ate a chestnut

→ *chestnut* (nut)

NOUN.PLANT gastronomy

I pruned the chestnut tree

→ *chestnut* (tree)

NOUN.PLANT plants

Key question:
Do metaphors cross domains more than metonyms?

Theory (Kövecses):
Metonymy = within-domain
Metaphor = across domains

Faculty of Arts

Do Metaphors Cross Domains?

- **Same-category rate**: of all tropes, what fraction have source and target in the *same* category?
  (higher = more within-domain)

	XWND Domains (170)	
	Metaphor	Metonymy
Same-cat. rate	0.11	0.21

Metonymy stays within a domain nearly **twice** as often as metaphor (21% vs. 11%), and the source domain is a much stronger predictor of the target (NMI 0.41 vs. 0.32).

Faculty of Arts

Structural Patterns: What the Numbers Show

- Metaphors are more distant in the network than metonyms
- Source is more general than target (for both metaphors and metonyms, more so for metaphors)
- There are many significant differences but almost all with negligible effect size
  - We need to categorize metaphors/metonyms further to see interesting differences.
- Metonyms are more likely to share the same domain between source and target than metaphors, as Kövecses (2010) predicted.

Still investigating

- Frequency

Faculty of Arts

Roadmap

Faculty of Arts

Can we see how English metaphors are used cross-lingually?

- For example, are translations of linked pairs likely to be translated with the same word
  - If so then metaphor/metonymy holds cross language
- For example *head* “body part” is metaphorically extended to “person in charge” in English and this is also true in Japanese, (頭) Italian (*capo*) and many other languages
- But not all metaphors are shared: *head* “main part of a grammatical constituent” is not 頭 in Japanese

- ChainNet is made for English, but we can expect many of the tropes to work with other languages
- If only we had a large collection of lexicons, linked by senses to English!

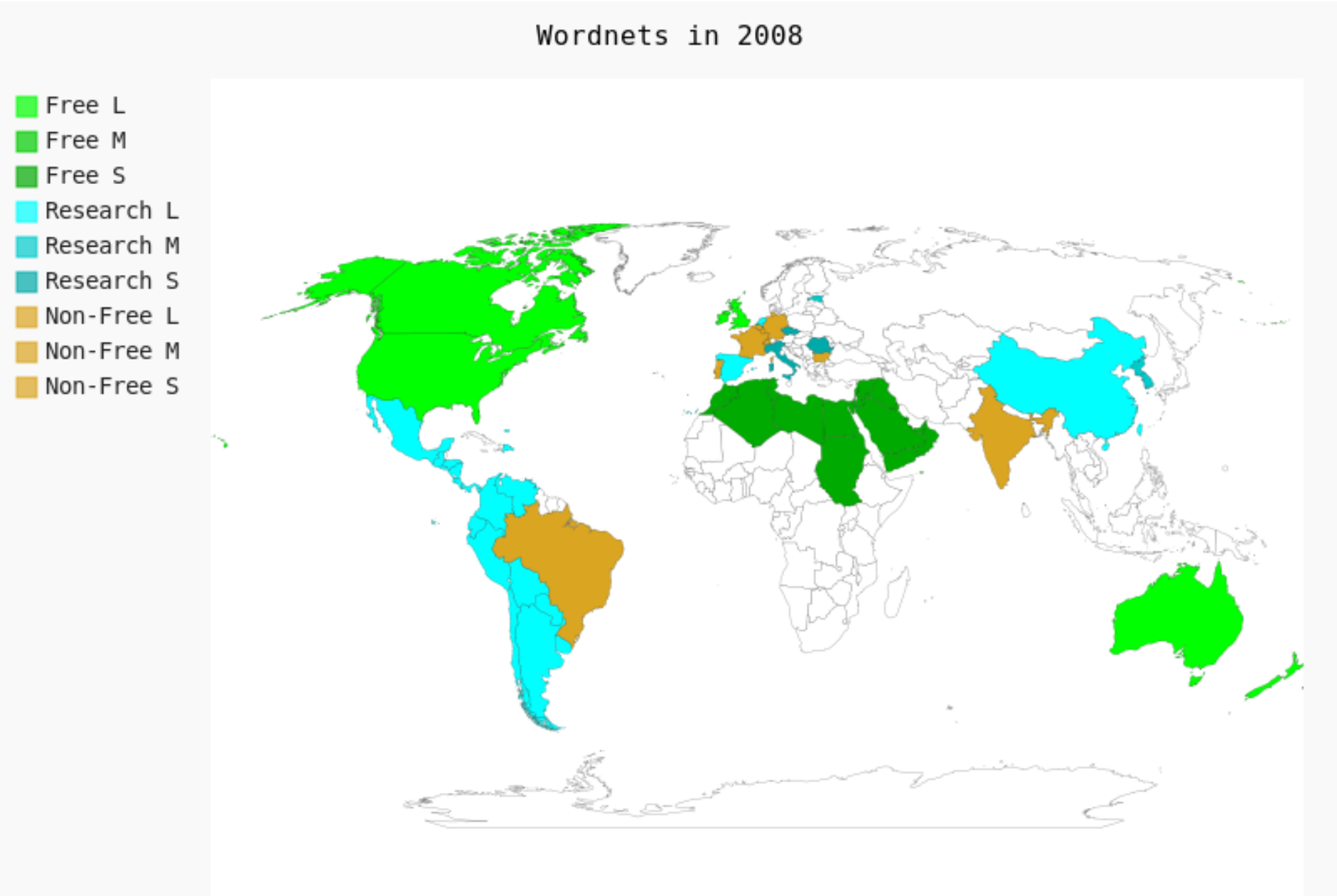
Faculty of Arts

Wordnets and the Open Multilingual Wordnet

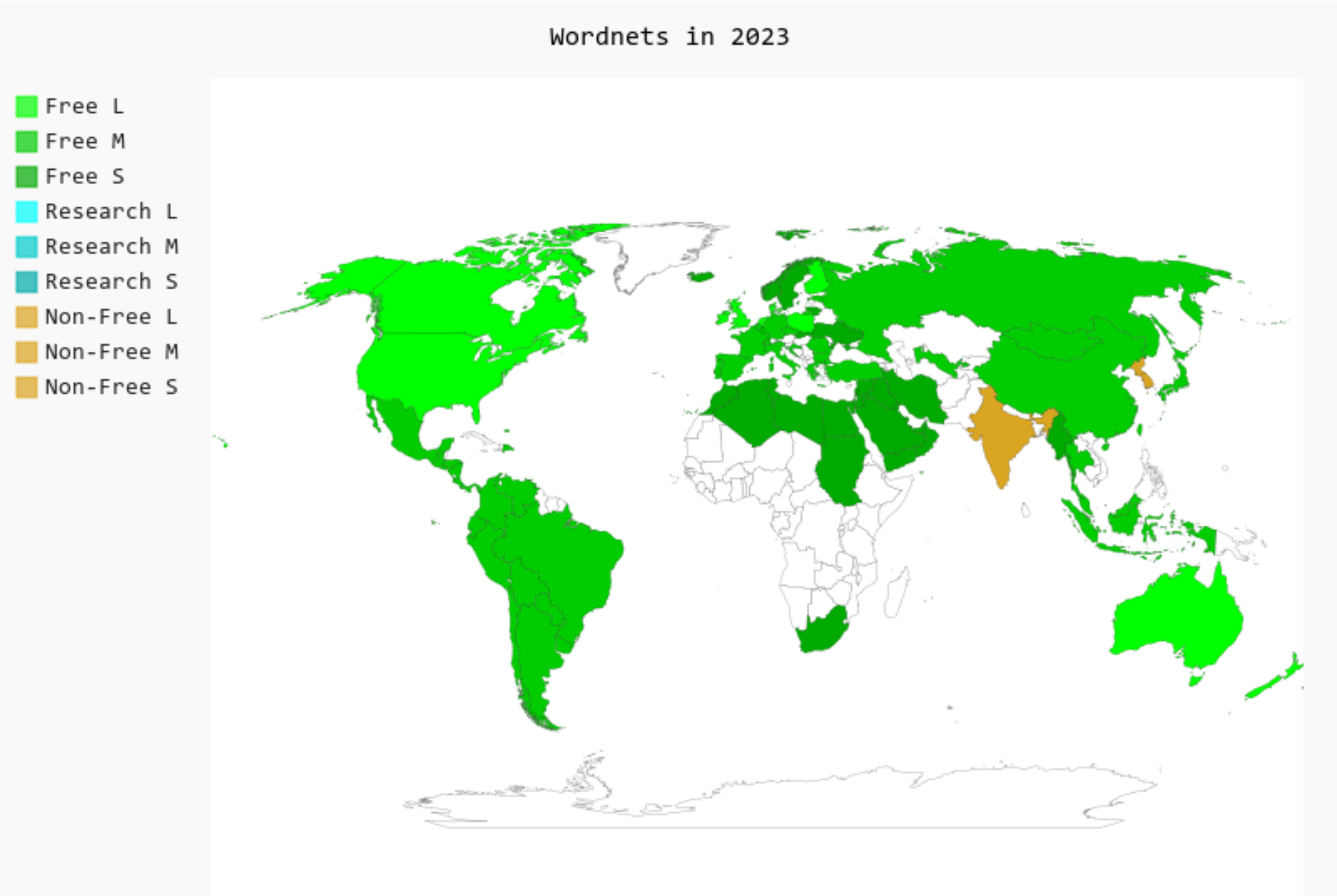
- A **wordnet** is a lexical database organising words into **synsets** (synonym sets), each representing a unique concept, linked by semantic relations: hypernymy, hyponymy, meronymy, …
- Over 50 hand-built wordnets exist; automatically-built wordnets cover over 1,200 languages (Wiktionary, Swadesh lists, …)
- The **Open Multilingual Wordnet** (OMW) links them all to Princeton WordNet senses under open licenses (Bond and Foster, 2013)
- **Key point for this talk**: if two English senses share a translation in another language, that language encodes the same semantic connection — so OMW translations let us test how far English metaphors and metonymies travel cross-linguistically

Faculty of Arts

Wordnets in the world 2008



Wordnets in the world 2023



The situation is much better! But not perfect

- The map shows the situation only for the major language for each country
  - India has over 450 living languages
  - Indonesia has over 700 living languages
  - Australia has over 100 indigenous languages and probably at least that many immigrant languages
  - Even Czechia recognizes Belarusian, German, Polish, Hungarian, Ukrainian and Vietnamese as official minority languages
- We are missing most of the world's languages
  - Most wordnets start by exploiting existing resources
    - bootstrap off English
  - But most of the world's languages do not have lexicons linked to English!

Faculty of Arts

How are wordnets built?

- Most new wordnets built by the **expand** method — the structure of English is used as a base, and new lemmas are added to the synsets
- Some wordnets are built by the **merge** method — an existing lexical resource is merged with the English Wordnet
- The IndoWordnet (Bhattacharyya, 2010) used a clever hybrid
  - a new structure was made for Hindi, using existing lexical resources
  - other Indic languages used this as a base for expand
  - but it is not under an open license, …

So we have many lexicons, linked to English senses, of various sizes and qualities, built with different methods by different people, …

Faculty of Arts

Measure the translation overlap with OMW

- For every English word that has been annotated
  - For each pair of English senses
  - Look up all translations of each sense
    measure the overlap (we use Jaccard similarity)
  - Store and note if the senses are linked or not
- So for example *head* has 3 senses (really many more)
  1. head, caput
     ヘッド, **頭**, 頭部
  2. head, chief, top dog
     大頭, 主任者, 御頭, 頭領, **頭**
  3. head, head word
     主要語
- Overlap
  - 1-2: 0.125
  - 2-3: 0
  - 1-3: 0

We do this for all the lexicons in OMW-1.4 I

Lang	Unlinked	Metaphor	Metonymy	Non-Zero Instances
sv	0.70	1.71	2.10	417
he	0.69	1.58	2.31	472
eu	0.82	1.30	1.80	5,562
ja	0.89	1.11	1.55	8,130
ro	0.83	1.30	1.71	6,429
sq	0.74	1.27	2.38	822
da	0.74	1.46	2.09	332
lt	0.63	1.46	2.86	692

- **unlinked** has no link
- **metaphor** is linked by metaphor
- **metonymy** is linked by metonymy

Normalize by dividing by the average distance for all senses.

Faculty of Arts

We do this for all the lexicons in OMW-1.4 II

Lang	Unlinked	Metaphor	Metonymy	Non-Zero Instances
es	0.85	1.17	1.79	5,915
hr	0.81	1.22	1.98	3,576
fr	0.94	1.10	1.25	18,975
nb	0.73	1.49	2.12	339
bg	0.73	1.54	2.11	380
gl	0.70	2.13	1.55	271
cmn	0.74	1.57	1.97	1,347
it	0.80	1.39	1.81	4,614
arb	0.74	1.28	2.38	1,337
pl	0.75	1.43	2.07	1,326
el	0.72	1.30	2.45	1,274
iwn	0.79	1.46	1.80	968
nn	0.73	1.52	2.10	340
id	0.87	1.21	1.58	9,803

Faculty of Arts

We do this for all the lexicons in OMW-1.4 III

Lang	Unlinked	Metaphor	Metonymy	Non-Zero Instances
is	0.73	1.51	2.13	388
ca	0.83	1.23	1.84	6,000
sk	0.73	1.35	2.31	2,067
fi	0.82	1.35	1.76	7,971
nl	0.79	1.38	1.90	2,991
sl	0.81	1.41	1.74	6,243
th	0.80	1.48	1.71	2,336
pt	0.80	1.26	1.96	5,414
zsm	0.87	1.22	1.60	10,272
Mean	0.78	1.39	1.96	3,774.3

Unlinked share fewer translations, metaphor shares more and metonymy shares much more.

Metonymy is more likely to hold cross linguistically!

Faculty of Arts

Discussion

- The wordnets are of vastly different sizes: the number of sense pairs that have a translation varies from 271 (Galician) to 18,975 (French).
- Only Galician has the score for metaphor (2.13) larger the score for metonymy (1.55), probably due to data sparsity. We would expect it to behave much like Portuguese (1.26/1.96).
- In order to measure perfectly how well tropes carry over between languages, we would need to mark metonymy and metaphor systematically for each language, and make sure all synsets for all senses have all relevant translations, …
- Without exception, senses linked by tropes are more likely to have an identical translation that those senses which are not linked
- With one exception, metonymy is more likely to have an identical translation then metaphor

Faculty of Arts

Translations of the senses of *cherry*

Sense	Mandarin	Japanese	Finnish	Italian
cherry$_1$	樱桃木	桜, 桜材	kirsikkapuumetsä	ciliegio
cherry$_2$	樱桃树	桜, 櫻	kirsikkapuu	ciliegio
cherry$_3$	樱桃	桜桃, 桜ん坊	kirsikka	cerasa , ciliegia
cherry$_4$	樱桃红	桜ん坊色	kirsikanpunainen	ciliegia, rosso ciliegia

- When we look at the translations, we see that the metonymy that is unmarked in English, is marked in other languages
- Even within English, other synonyms have information

Faculty of Arts

Ongoing Research to Find Patterns

- We can make a searchable database where the edges are decorated by the morphological differences
  - So we can see all pairs linked by EN:+ TREE or DA:+TRÆ
  - The nodes link to synsets, so we can look up supertypes: we can say this link is of type FOOD:PLANT
    or PLANT IS FOOD in the cognitive linguistic style
  - Another way to group the tropes together in families
  - Similar to Stoyanova et al. (2025)
- Other people have done this top down (Khishigsuren et al., 2022, e.g start at FOOD:PLANT and looked for examples)
- With ChainNet we can go bottom-up and find many more patterns
  - We can use multi-lingual features
  - We need to investigate methods of clustering
  - We need to find a good way of evaluating
- We are linking this with our mapping to Conceptual Metaphors

Faculty of Arts

The Patterns can be used Generatively

- If we see a word that is of type FOOD, then we can expect that there may be a kind of plant using the same word
  - Useful for analyzing texts that otherwise don't make sense
  - Can be used to analyse humour and word play

BBC Spaghetti Tree hoax (1957)

Faculty of Arts

We will mark metaphor/metonymy in more languages

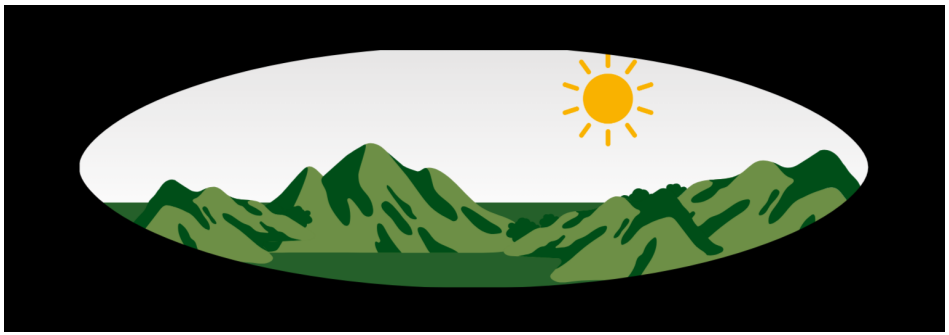
闇 *yami* (Japanese)
yami $_1$ — absence of light or illumination (Japanese wordnet)
yami $_2$ — an unilluminated area “he moved off into the darkness” (Japanese wordnet)
yami $_3$ — absence of moral or spiritual values “the powers of darkness” (Japanese wordnet)
yami $_4$ — an illegal market […] (not in English)

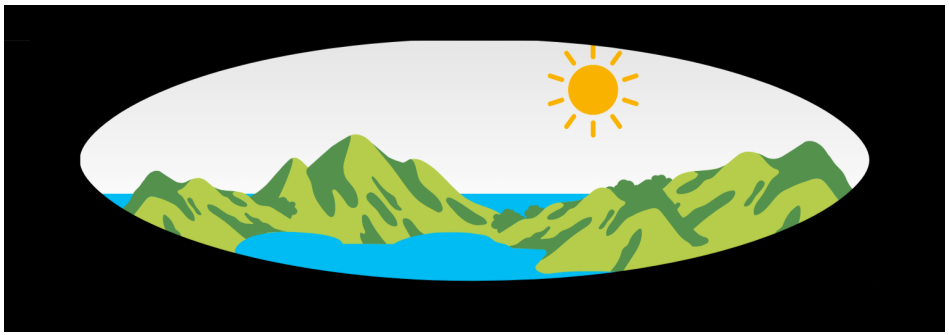
yami $_1 \rightarrow$ ***yami*** $_2$ (metonymy)
yami $_1 \rightarrow$ ***yami*** $_3$ (metaphor)
yami $_3 \rightarrow$ ***yami*** $_4$ (metaphor)

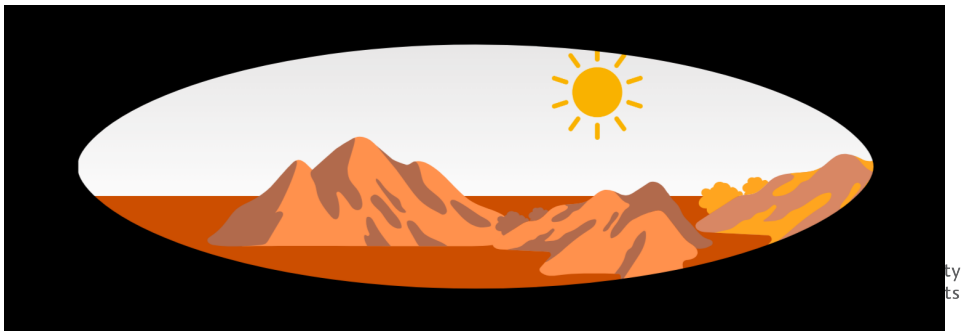
We can start by projecting from English, then use the morphological patterns, …

Faculty of Arts

Corpus-attested lexicalized metaphors for many languages: a range of views







Roadmap

Faculty of Arts

Metaphor in Large Language Models

- Because these tropes are so established, LLMs capture the patterns well, and can generalise to novel examples, at least for languages with a lot of online data
- E.g. For Spanish, Puraivan et al. (2024) found ChatGPT could differentiate literal from metaphorical senses with an accuracy of 85-88% (on a small dataset)
  - This is high enough to cause **automation blindness**
  - It is very hard for a human to spot mistakes
- There are also interesting questions of how much metaphor interpretation in multilingual models is effected by other languages The DanNet group have found metaphors in Danish not found in English are less likely to be recognized

Faculty of Arts

Evaluating LLM-Generated Explanations of Metaphors (Pedersen et al., 2025)

- Metaphors have culturally distinct imagery and semantics (e.g., agricultural or national norms).
- Standard benchmarks (often English-centric) may hide biases against medium-resource languages.
- LLMs may transfer English knowledge inappropriately to other languages.

Models evaluated:

- **ChatGPT-4o mini** via web/API (multilingual, but English-heavy training)
- **Llama 3.1 405B**, large open model (multilingual but likewise English-biased).

Tested on a culturally sensitive evaluation dataset of Danish metaphors & model explanations.

Faculty of Arts

Dataset and Experimental Design

Metaphor dataset: 150 Danish expressions

- 75 single-word metaphors + 75 multiword idioms
- Divided into:
  - **Culture-specific** Danish metaphors (e.g., farming/nautical, social norms)
  - **Cross-cultural** ones shared with English
- Validated by native speakers and bilingual informants

Prompting setup:

- Four prompt variants:
  - In isolation vs. with context
  - Danish vs. English prompt language
- Each model generated 600 explanations (all combinations)

Evaluation:

- Human expert judges explanations on a 4-point qualitative scale

Faculty of Arts

Key Findings and Discussion

Main results:

- Both models explain **cross-cultural metaphors** far better than culture-specific ones
- Models show a strong **English bias** — higher quality explanations are produced when metaphors overlap with English
- Culture-specific sentiment and nuance are often lost in translation

Implications:

- Bias arises not only from data distribution but also from *erroneous transfer* of English metaphorical knowledge.
- Culturally grounded metaphor understanding in non-English languages remains a challenge for current multilingual LLMs

Faculty of Arts

Two examples

(1) *Han skød hendes argumenter ned.* Danish

He shot down her arguments.

- Correctly identifies metaphorical usage
- Maps **physical attack** $\rightarrow$ **argumentation**
- Produces fluent, accurate explanation

(2) *Han har rent mel i posen.* Danish

He has nothing to hide (Lit: He has clean flour in the bag.)

- Plausible but wrong English-based metaphor
  "This metaphor refers to being prepared or well-supplied."
- Over-literal explanation
  "Clean flour symbolizes purity of intentions" but without connecting it to social trust / transparency
- Misses social–cultural grounding

LLMs handle metaphor well when it aligns with English conventions, but struggle with *lexicalized, culturally grounded metaphors*.

Faculty of Arts

Summary

- The combination of detailed annotation of meaning (ChainNet & Wordnet) and cross-lingual links (Open Multilingual) allow us to explore differences in lexicalized metaphor
  - Metonymy is based on association and contiguity **more universal** (average overlap 1.96 more than the baseline)
  - Metaphor often requires analogical reasoning and cultural framing **more culture and language specific** (average overlap 1.39 more than the baseline)
  - Metaphor pairs are further apart than Metonym pairs
- We have shown these results hold over many languages

Faculty of Arts

Toward a broader understanding of Metaphor and Metonymy

- Language is essential to our construction and transmission of knowledge
- Metaphors are the scaffolding for this construction
- For a full understanding of language we have to understand metaphors
- At the highest level, metaphors are very culturally embedded, to speak well you must understand the culture as well
  - And the same language speakers will have many sub-cultures
- Understanding cross-linguistic differences will help us understand cross-cultural differences

We are building an understanding based on a more complete view of language

Faculty of Arts

Roadmap

Faculty of Arts

Thanks and Resources

- Thanks to Erasmus for supporting this visit
- Thanks to all the many people who have worked on these resources, especially Rowan Hall Maudslay, Luís Morgado da Costa and Joanna Ut-Seong Sio.
- Parts of this talk were presented at the 2026 LOT winter school Schultink lecture, RegICON 2025 and Sprogteknologisk Konference 2024

- If you are interested in wordnets or metaphor, come and talk to me!

- ChainNet: https://github.com/rowanhm/ChainNet
  - chainnet-xling: https://github.com/bond-lab/chainnet-xling
- Open Multilingual Wordnet: https://omwn.org

Faculty of Arts

We used these Wordnets

- The combined wordnets include English (Fellbaum, 1998), Albanian (Ruci, 2008), Arabic (Elkateb et al., 2006), Chinese (Huang et al., 2010), Danish (Pedersen et al., 2009), Finnish (Lindén and Carlson., 2010), French (Sagot and Fišer, 2008), Hebrew (Ordan and Wintner, 2007), Indonesian and Malaysian (Nurril Hirfana et al., 2011), Italian (Pianta et al., 2002; Toral et al., 2010), Japanese (Isahara et al., 2008), Norwegian Bokmål and Norwegian Nynorsk (Lars Nygaard, personal communication 2012), Persian (Montazery and Faili, 2010), Portuguese (de Paiva and Rademaker, 2012); Polish (Piasecki et al., 2009), Thai (Thoongsup et al., 2009), and Basque, Catalan, Galician and Spanish (Gonzalez-Agirre et al., 2012).
- Data is available from `https://github.com/omwn/omw-data`
- We used the python **wn** module (Goodman and Bond, 2021)

Faculty of Arts

References I

Pushpak Bhattacharyya. 2010. Indowordnet. In *LREC 2010*.

Francis Bond and Merrick Choo. 2022. Sense and sentiment. In *13th International Conference on Language Resources and Evaluation (LREC 2022)*. Marseilles.

Francis Bond and Ryan Foster. 2013. Linking and extending an open multilingual wordnet. In *51st Annual Meeting of the Association for Computational Linguistics: ACL-2013*, pages 1352–1362. Sofia. URL http://aclweb.org/anthology/P13-1133.

Francis Bond and Rowan Hall Maudslay. 2025. Metonymy is more multilingual than metaphor: Analysing tropes using ChainNet and the open multilingual wordnet. In *13th International Global Wordnet Conference (GWC2025)*. Pavia.

Valeria de Paiva and Alexandre Rademaker. 2012. Revisiting a Brazilian wordnet. In *Proceedings of the 6th Global WordNet Conference (GWC 2012)*. Matsue.

Faculty of Arts

References II

Sabri Elkateb, William Black, Horacio Rodríguez, Musa Alkhalifa, Piek Vossen, Adam Pease, and Christiane Fellbaum. 2006. Building a wordnet for Arabic. In *Proceedings of The fifth international conference on Language Resources and Evaluation (LREC 2006)*.

Christine Fellbaum, editor. 1998. *WordNet: An Electronic Lexical Database*. MIT Press.

Aitor González, German Rigau, and Mauro Castillo. 2012. A graph-based method to improve wordnet domains. In *Proceedings of the 13th International Conference on Computational Linguistics and Intelligent Text Processing - Volume Part I*, CICLing'12, page 17–28. Springer-Verlag, Berlin, Heidelberg. URL https://doi.org/10.1007/978-3-642-28604-9_2.

Faculty of Arts

References III

Aitor Gonzalez-Agirre, Egoitz Laparra, and German Rigau. 2012. Multilingual central repository version 3.0: upgrading a very large lexical knowledge base. In *Proceedings of the 6th Global WordNet Conference (GWC 2012)*. Matsue.

Michael Wayne Goodman and Francis Bond. 2021. Intrinsically interlingual: The Wn Python library for wordnets. In *11th International Global Wordnet Conference (GWC2021)*.

Chu-Ren Huang, Shu-Kai Hsieh, Jia-Fei Hong, Yun-Zhu Chen, I-Li Su, Yong-Xiang Chen, and Sheng-Wei Huang. 2010. Chinese wordnet: Design and implementation of a cross-lingual knowledge processing infrastructure. *Journal of Chinese Information Processing*, 24(2):14–23. (in Chinese).

Faculty of Arts

References IV

Hitoshi Isahara, Francis Bond, Kiyotaka Uchimoto, Masao Utiyama, and Kyoko Kanzaki. 2008. Development of the Japanese WordNet. In *Sixth International conference on Language Resources and Evaluation (LREC 2008)*. Marrakech.

Temuulen Khishigsuren, Gábor Bella, Thomas Brochhagen, Daariimaa Marav, Fausto Giunchiglia, and Khuyagbaatar Batsuren. 2022. Metonymy as a universal cognitive phenomenon: Evidence from multilingual lexicons. URL osf.io/preprints/psyarxiv/f6yjt.

Zoltán Kövecses. 2010. *Metaphor: A Practical Introduction*. Oxford University Press, Oxford, second edition.

Krister Lindén and Lauri Carlson. 2010. Finnwordnet — wordnet påfinska via översättning. *LexicoNordica — Nordic Journal of Lexicography*, 17:119–140. In Swedish with an English abstract.

Faculty of Arts

References V

Rowan Hall Maudslay, Simone Teufel, Francis Bond, and James Pustejovsky. 2024. ChainNet: Structured metaphor and metonymy in WordNet. In Nicoletta Calzolari, Min-Yen Kan, Veronique Hoste, Alessandro Lenci, Sakriani Sakti, and Nianwen Xue, editors, *Proceedings of the 2024 Joint International Conference on Computational Linguistics, Language Resources and Evaluation (LREC-COLING 2024)*, pages 2984–2996. ELRA and ICCL, Torino, Italy. URL https://aclanthology.org/2024.lrec-main.266.

George A. Miller. 1995. WordNet: A lexical database for English. *Commun. ACM*, 38(11):39–41. URL http://doi.acm.org/10.1145/219717.219748.

Nurril Hirfana Mohamed Noor, Suerya Sapuan, and Francis Bond. 2011. Creating the open Wordnet Bahasa. In *Proceedings of the 25th Pacific Asia Conference on Language, Information and Computation (PACLIC 25)*, pages 258–267. Singapore.

Faculty of Arts

References VI

Mortaza Montazery and Heshaam Faili. 2010. Automatic Persian wordnet construction. In *23rd International conference on computational linguistics*, pages 846–850.

Noam Ordan and Shuly Wintner. 2007. Hebrew wordnet: a test case of aligning lexical databases across languages. *International Journal of Translation*, 19(1):39–58.

Bolette S. Pedersen, Nathalie Sørensen, Sanni Nimb, Dorte Haltrup Hansen, Sussi Olsen, and Ali Al-Laith. 2025. Evaluating LLM-generated explanations of metaphors – a culture-sensitive study of Danish. In Richard Johansson and Sara Stymne, editors, *Proceedings of the Joint 25th Nordic Conference on Computational Linguistics and 11th Baltic Conference on Human Language Technologies (NoDaLiDa/Baltic-HLT 2025)*, pages 470–479. University of Tartu Library, Tallinn, Estonia. URL https://aclanthology.org/2025.nodalida-1.51/.

Faculty of Arts

References VII

Bolette Sandford Pedersen, Sanni Nimb, Jørg Asmussen, Nicolai Hartvig Sørensen, Lars Trap-Jensen, and Henrik Lorentzen. 2009. DanNet — the challenge of compiling a wordnet for Danish by reusing a monolingual dictionary. *Language Resources and Evaluation*, 43(3):269–299.

Emanuele Pianta, Luisa Bentivogli, and Christian Girardi. 2002. Multiwordnet: Developing an aligned multilingual database. In *Proceedings of the First International Conference on Global WordNet*, pages 293–302. Mysore, India.

Maciej Piasecki, Stan Szpakowicz, and Bartosz Broda. 2009. *A Wordnet from the Ground Up*. Wroclaw University of Technology Press. URL http://www.plwordnet.pwr.wroc.pl/main/content/files/publications/A_Wordnet_from_the_Ground_Up.pdf, (ISBN 978-83-7493-476-3).

Faculty of Arts

References VIII

E. Puraivan, I. Renau, and N. Riquelme. 2024. Metaphor identification and interpretation in corpora with ChatGPT. *SN Computer Science*, 5:976.

Ervin Ruci. 2008. On the current state of Albanet and related applications. Technical report, University of Vlora. (http://fjalnet.com/technicalreportalbanet.pdf).

Benoît Sagot and Darja Fišer. 2008. Building a free French wordnet from multilingual resources. In European Language Resources Association (ELRA), editor, *Proceedings of the Sixth International Language Resources and Evaluation (LREC'08)*. Marrakech, Morocco.

Ivelina Stoyanova, Verginica Barbu Mititelu, Svetlozara Leseva, and Gianina Iordachioaia. 2025. Expanding and enhancing derivational and morphosemantic relations in princeton wordnet. In *GWC 2025*.

Faculty of Arts

References IX

Sareewan Thoongsup, Thatsanee Charoenporn, Kergrit Robkop, Tan Sinthurahat, Chumpol Mokarat, Virach Sornlertlamvanich, and Hitoshi Isahara. 2009. Thai wordnet construction. In *Proceedings of The 7th Workshop on Asian Language Resources (ALR7), Joint conference of the 47th Annual Meeting of the Association for Computational Linguistics (ACL) and the 4th International Joint Conference on Natural Language Processing (IJCNLP),*. Suntec, Singapore.

Antonio Toral, Stefania Bracale, Monica Monachini, and Claudia Soria. 2010. Rejuvenating the italian wordnet: upgrading, standardising, extending. In *Proceedings of the 5th International Conference of the Global WordNet Association (GWC-2010)*. Mumbai.

Piek Vossen, editor. 1998. *Euro WordNet*. Kluwer.

Faculty of Arts