A Database for Modal Semantic Typology

Qingxia Guo, Nathaniel Imel,
Shane Steinert-Threlkeld

Overview

- What are modals? What do modals look like in natural languages?
- What does our database do?
- How to collect data and contribute to the database?
- What are some use cases of this database?
- Some reflections and possible future works

Semantics Universal of Modals

- Modals as ablity to talk about possible worlds
- Semantics of modals have been explicated in terms of two axes of variation: force and flavor (Kratzer 1981).
- Force: strong (necessity), weak (possiblity) , …
- Flavor: epistemic, deontic (...)

Examples of English Modals

	Context	Expression	Axes Values
(1)	A friend walks in and shakes off a wet umbrella. You say:	It must be raining.	strong epistemic
(2)	You are reading the specifications of a homework assignment. It partially reads:	You *must* upload your homework as a PDF.	strong deontic
(3)	A friend is leaving and grabs an umbrella on the way out, saying:	It *may* be raining	weak epistemic
(4)	A mother offers a treat to a child for finishing an assignment, saying:	You *may* have a cookie	weak deontic

Table 1: Examples of force and flavors in English.

Examples of St’át’icmets Modals

(3) a. [Context: You have a headache that won’t go away, so you go to the doctor. All the tests show negative. There is nothing wrong, so it must just be tension.]

nilh *k’a* lh(el)-(t)-en-s-wá(7)-(a) ptinus-em-sút
FOC INFER from-DET-1SG.POSS-NOM-IMPF-DET think-MID-OOC

‘It *must* be from my worrying.’

b. [Context: His car isn’t there.]

plan k’a qwatsáts
already INFER leave

‘Maybe he’s already gone.’

source: Rullmann, H., Matthewson, L., & Davis, H. (2008)

Database for Modals in Natural Languages

- Ideally, we would like to derive a full paradigm of modal expression and (force,flavor) pair with can_express value in natural languages so that we can acquire the meaning representation of modals.

expression	force	flavor	can_express
may	weak	epistemic	1
may	weak	deontic	1
may	strong	epistemic	0
may	strong	deontic	0

Table 1: Example of our basic data format for English *m*

Modal		Meaning representation			
		e	d	c	t
may	$\exists$	✓	✓		
	$\forall$				

Database for Modals in Natural Languages

- 17 languages, 5 from semantics fieldwork, 12 from reference grammar
- https://github.com/CLMBRs/modal-typology

Language	Glotto.code	Reference.key	Reference.type	Complete.language
Donmari	doma1258	(Matras, 2012)	reference-grammar	True
Gitksan	gitx1241	(Matthewson, 2013)	paper-journal	True
Goemai	goem1240	(Hellwig, 2011)	reference-grammar	True
Hinuq	hinu1240	(Forker, 2013)	reference-grammar	True
Hup	hupd1244	(Epps, 2005)	reference-grammar	True
Jamul-Tipay	kumi1248	(Miller, 2001)	reference-grammar	True
Javanese-Paciran	java1254	(Vander Klok, 2013a)	paper-journal	True
Kwaza	kwaz1243	(Voort, 2004)	reference-grammar	True
Lillooet-Salish	lill1248	(Rullmann et al., 2008b)	paper-journal	True
Logoori	logo1258	(Gluckman and Bowler, 2020)	paper-journal	True
Mani	bull1247	(Childs, 2011)	reference-grammar	True
Mian	mian1256	(Fedden, 2011)	reference-grammar	True
Nuosu	sich1238	(Gerner et al., 2013)	reference-grammar	True
Qiang	nort2722	(LaPolla and Huang, 2003)	reference-grammar	True
Tlingit	tlin1245	(Cable, 2017)	paper-journal	True
Tundra-Nenets	nene1249	(Nikolaeva, 2014)	reference-grammar	True
Vaeakau-Taumako	pile1238	(Næss, 2011)	reference-grammar	True

Table 3: Snapshot of current metadata in the Modal Typology Database. Note: we have replaced the 'Reference.key' column with actual references using those keys.

Data Format

- Raw format (/basic-format):
  - modal.csv: expressions, force-flavor pair and can_express values for each language
  - metadata.yml: contains information about language, source and citation
- CLDF format (/cldf-format):
  - convert raw format into a database in the Cross-Linguistics Dataset Format
  - CLDF format can be later consumed by tools to develop interactive web applications

Contributing to database (more details in **contributing.md)**:

- Fork the github repository
- Create a language folder under **/basic-format**
- Add file **metadata.yml, modals.csv** to the created folder
- Edit **source.bib** to reflect source of the data
- Submit a pull request to the main repository

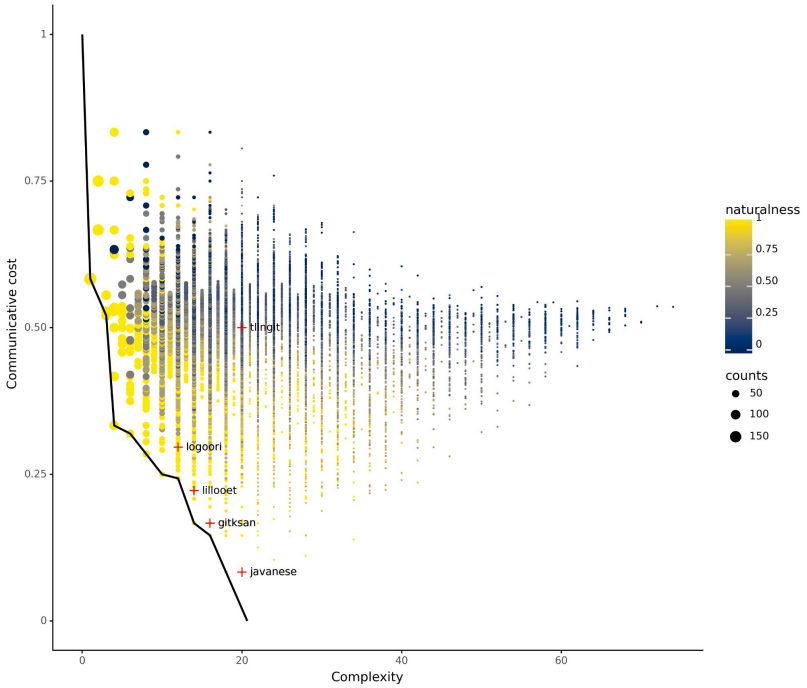
Data Collection

There are several ways of collecting modals in natural languages

- From descriptive source
  - targeted semantics fieldwork
  - general reference grammar
- From elicitation
  - consult native speakers directly with pre-established questionnaire (Vander Klok, 2021)
  - crowdsource semantics elicitation (Beekhuizen and Stevenson, 2015)
    - more applicable to dominant languages

Use Case: Efficient Communication Analysis

- Simplicity - informativeness tradeoff in **artificial** languages
- **Naturalness** significantly correlated to **optimality**
- What about actual **natural** languages?



source: Imel, N., & Steinert-Threlkeld, S. (2022).

Use Case: IFF

- Independence of Force and Flavor (Steinert-Threlkeld et al., 2022)
  - all modals in natural languages satisfy the independence of force and flavor property
  - if a modal can express (fo1,fl1) and (fo2,fl2), then it can also express (fo1,fl2) and (fo2,fl1)
- We provide a simple tool **iff.py** to check whether this property holds for languages in the database and output counter examples if there's any.

Conclusion

- Introduced a database on modal typology
- Collected data in various format and from various sources
- Employed to several use cases (efficient communication & IFF)

Future Work

- Data visualization using CLDF format
- Extend the database using semantics elicitation methods
- Detailed syntactic information about modal expressions

Thank you!

Questions?

Selected References

- Imel, N., & Steinert-Threlkeld, S. (2022). Modals in Natural Language Optimize the Simplicity/Informativeness Trade-Off. Proceedings of Semantics and Linguistic Theory (SALT 32)
- Rullmann, H., Matthewson, L., & Davis, H. (2008). Modals as distributive indefinites. Natural Language Semantics, 16(4), 317–357. http://www.jstor.org/stable/23748121
- Steinert-Threlkeld, S., Imel, N., & Guo, Q. (2022). A Semantic Universal for Modality. Submitted to *Semantics and Pragmatics*.
- Beekhuizen, B., & Stevenson, S. (2015). Crowdsourcing elicitation data for semantic typologies. Cognitive Science.
- Vander Klok, J. (2021). Revised Modal Questionnaire for Cross-Linguistic Use. Unpublished.