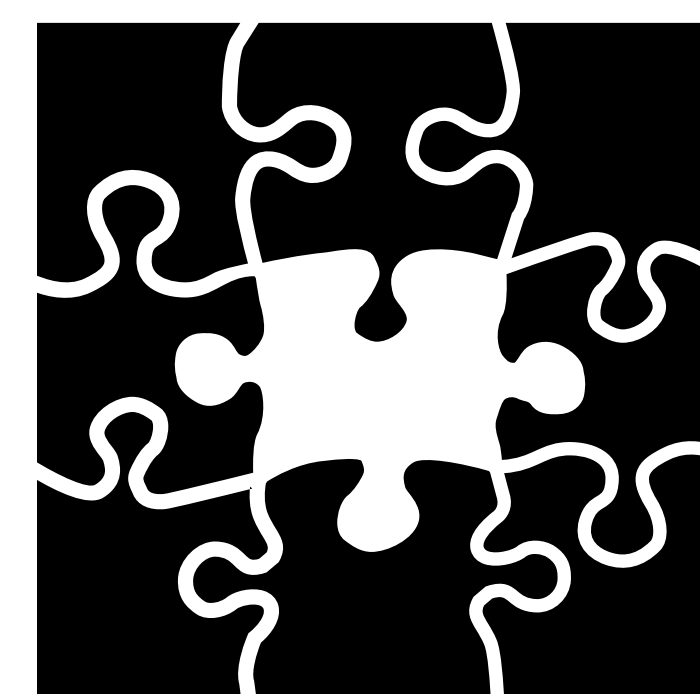




# Universal Reordering via Linguistic Typology

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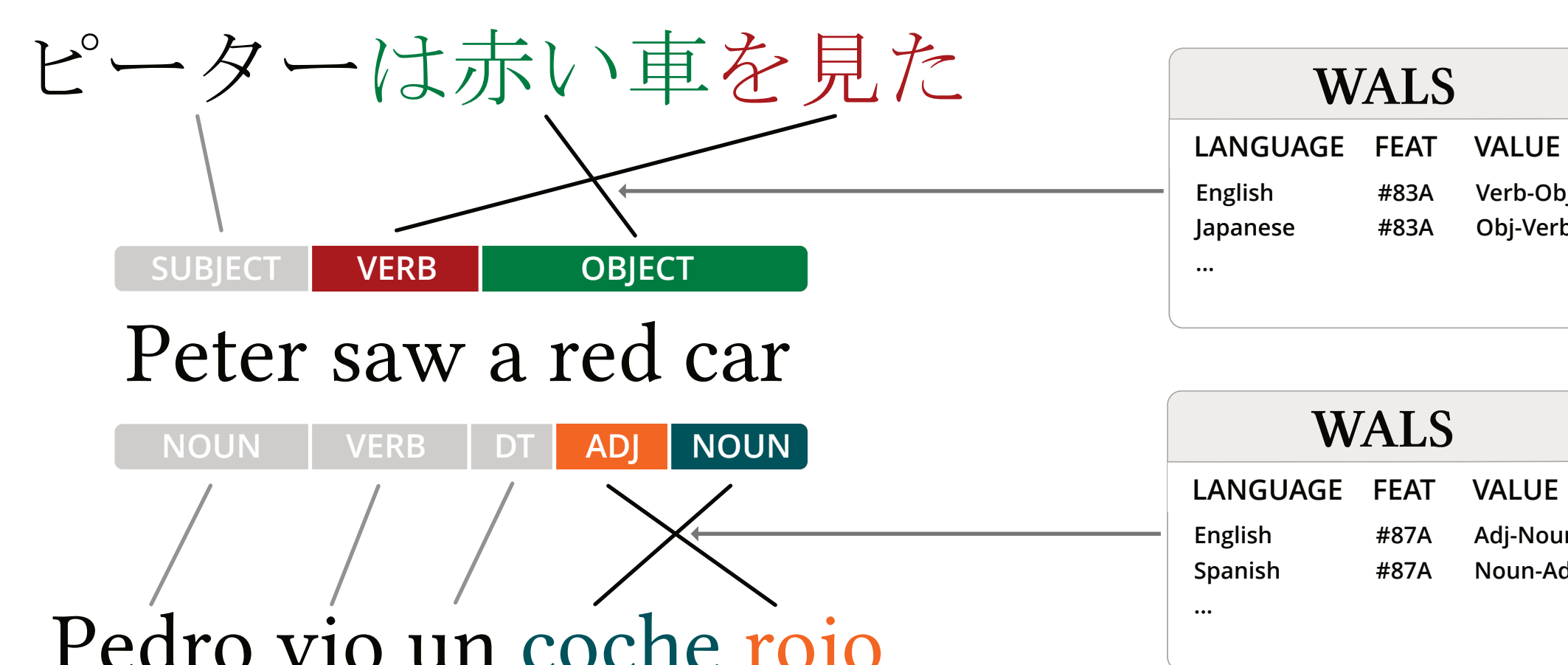
## OVERVIEW

**Intuition:** Linguistic typology describes common and salient features of languages.

**Question:** Can we exploit typological knowledge for reordering in MT?

**Evaluation:** Build *universal reordering model* for translation of 22 language pairs.

## REORDERING & WALS

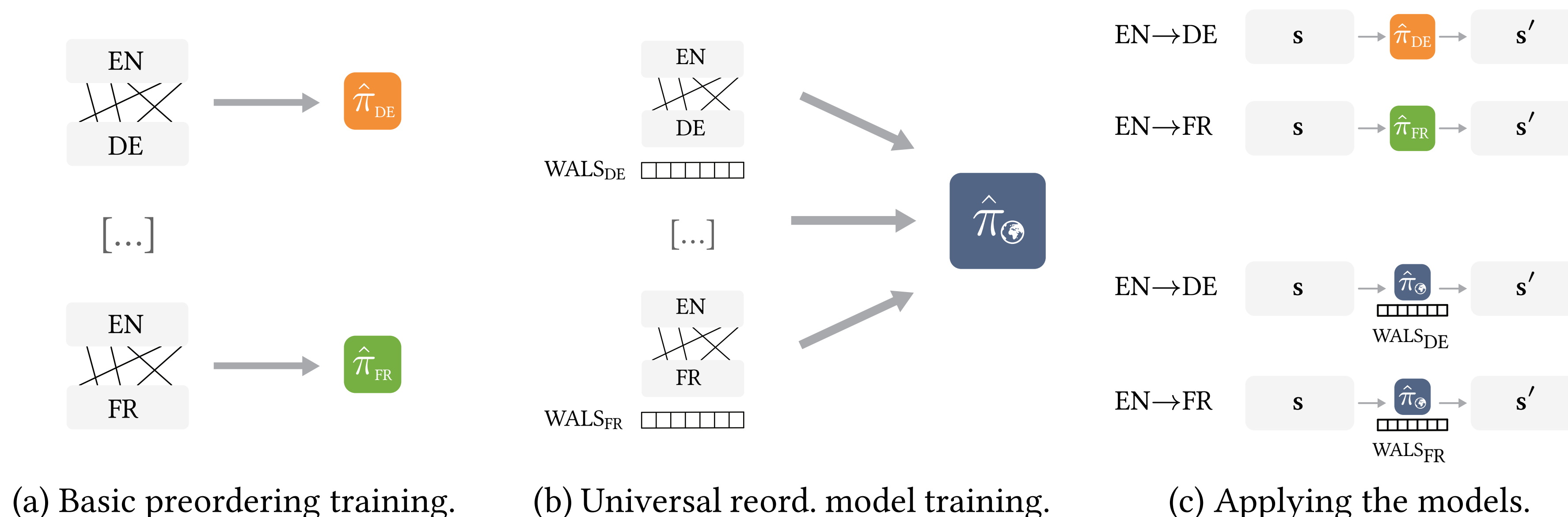


## LINGUISTIC TYPOLOGY

World Atlas of Language Structures [1]

- 2,679 languages
- 192 features (32 relevant to reordering)
- One feature vector per language

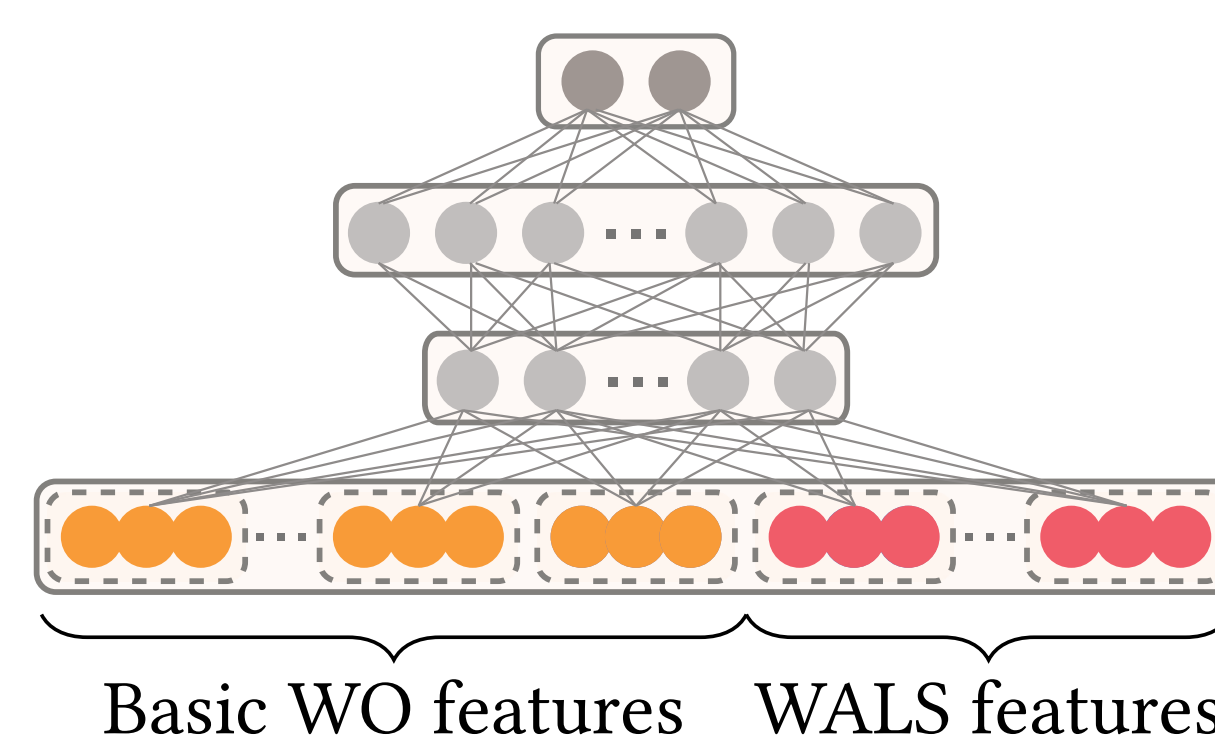
## UNIVERSAL REORDERING



## EVALUATION

- Phrase-based MT (Moses):
  - $k$ -best WO predictions via lattice
  - No reordering in decoder [2]
- English to many target languages
- Two datasets:
  - Subtitles (800k sentence pairs each)
  - News/Parl. (1m+ sentence pairs each)

## BUILDING A UNIVERSAL REORDERING MODEL



- Estimate swap probabilities for source dependency tree nodes.
- Graph search for best permutation [3].
- Train combined corpus of all language pairs.
- Big variance between language pairs.
  - Randomize source WO for class balance.

## MAIN FINDINGS

- Single, universal reordering model
  - built using WALS data
  - works for diverse set of languages
- Linguistic typology
  - can inform reordering models
  - provides adequate descriptions
  - can benefit low-resource setting

## TRANSLATION EXPERIMENTS

Language	BLEU		Δ BLEU		Language	BLEU		Δ BLEU	
	Baseline	No WALS	WALS ↓	Gold		Baseline	No WALS	WALS ↓	Gold
Dutch	13.76	+0.11	+0.79	+3.44	Greek	7.22	−0.02	+0.01	+0.49
Italian	23.59	+0.04	+0.48	+1.83	Arabic	5.36	−0.10	−0.01	+0.36
Turkish	5.89	−0.36	+0.43	+0.80	Swedish	25.60	−0.14	−0.03	+2.04
Spanish	23.82	−0.27	+0.29	+1.98	Slovenian	10.56	−0.35	−0.10	+1.21
Portuguese	25.94	−0.48	+0.21	+1.64	Slovak	15.56	−0.09	−0.13	+1.98
Finnish	9.95	+0.13	+0.16	+0.51	Icelandic	14.97	−0.31	−0.14	+0.66
Hebrew	11.64	+0.30	+0.11	+2.24	Polish	17.68	−0.45	−0.16	+0.40
Romanian	16.11	+0.11	+0.11	+1.14	Russian	20.12	−0.47	−0.17	+0.92
Hungarian	8.26	−0.10	+0.10	+0.61	German	17.08	−0.21	−0.19	+3.31
Danish	26.36	−0.13	+0.08	+1.56	Czech	12.81	−0.47	−0.21	+0.70
Chinese	11.09	−0.32	+0.05	+0.44	French	19.92	−0.70	−0.23	+1.20

## REFERENCES

- [1] Matthew S. Dryer and Martin Haspelmath, editors. *WALS Online*. Max Planck Institute for Evolutionary Anthropology, Leipzig, 2013.
- [2] Joachim Daiber, Miloš Stanojević, Wilker Aziz, and Khalil Sima'an. Examining the relationship between preordering and WO freedom in MT. In *WMT 2016*.
- [3] Adrià de Gispert, Gonzalo Iglesias, and Bill Byrne. Fast and accurate preordering for SMT using neural networks. In *NAACL: HLT 2015*, 2015.

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