MODELING THE ACQUISITION OF NOUN CLASSES IN TSEZ

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Tsez Language

- 6,000 speakers

https://commons.wikimedia.org/wiki/File:Caucasus-ethnic_en.svg

Tsez Language Noun Classes

- Grammatical Gender = Noun Classes

- Tsez has 4 classes

Class 1	Class 2	Class 3	Class 4
∅-igu uži	j-igu kid	b-igu k'et'u	r-igu čorpa
1-good boy	2-good girl	3-good cat	4-good soup
good boy	*good girl*	*good cat*	*good soup*

Tsez Noun Class Assignment

- Nouns fall into the four classes based on some combination of two things:
  - Their meaning (semantic info)
  - Their form (phonological info)

Example Semantic: male, clothing

Example Phonological: r- initial, -i final

Distributional Info of Tsez Nouns

- Gagliardi et al analyzed a corpus of Tsez nouns and assigned semantic and phonological features
- Assessed which features were most predictive of noun class assignment

→ Optimal Bayesian Learner uses these features

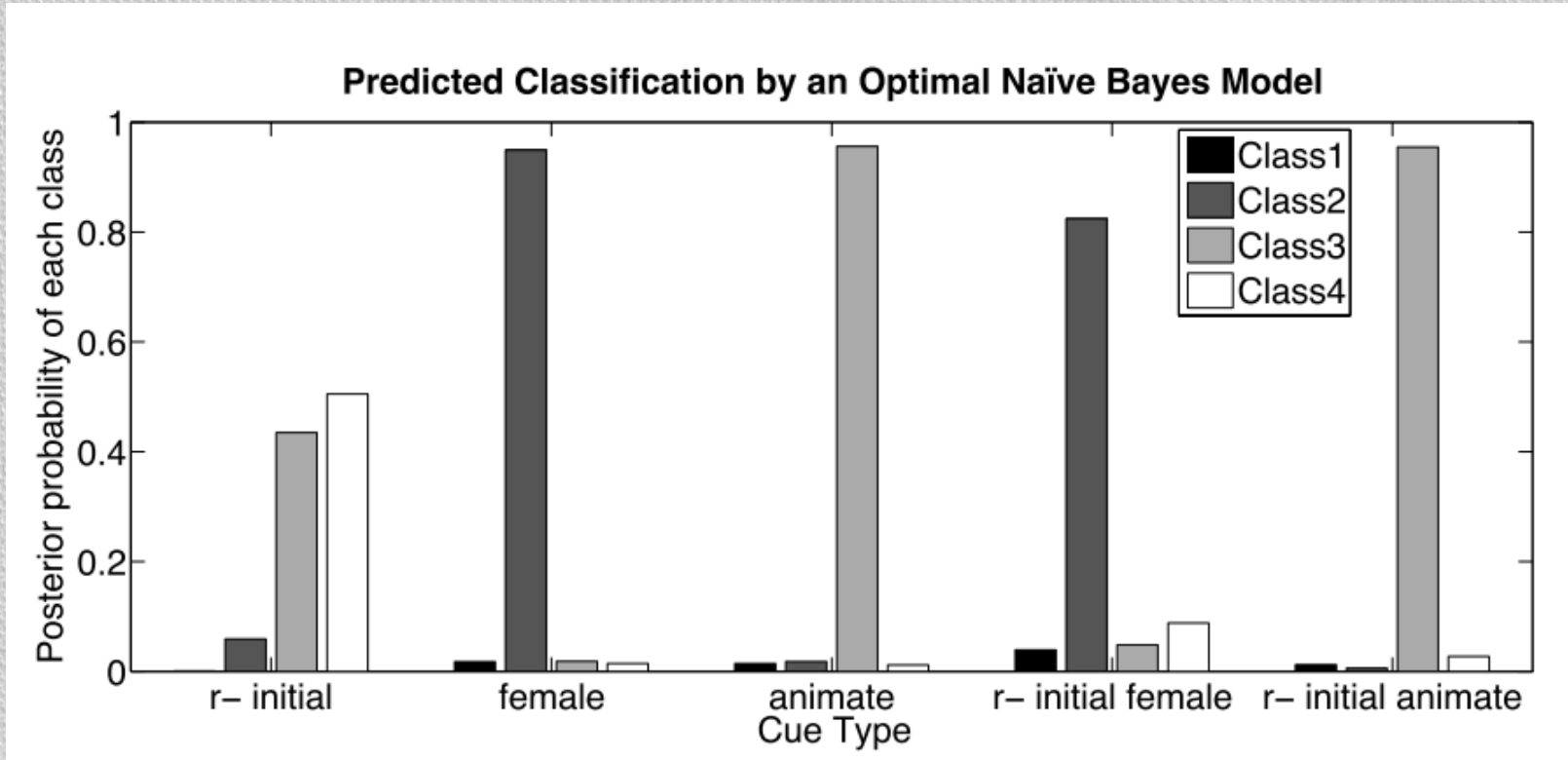
Predictive Features of Tsez Noun Class Assignment

- Table 3: Structure of Features (input to model)

Feature	Specified Values	Unspecified Value
Semantic	Male, female, animate	other
First Segment (phonological)	r-, b-	other
Final Segment (phonological)	-i	other

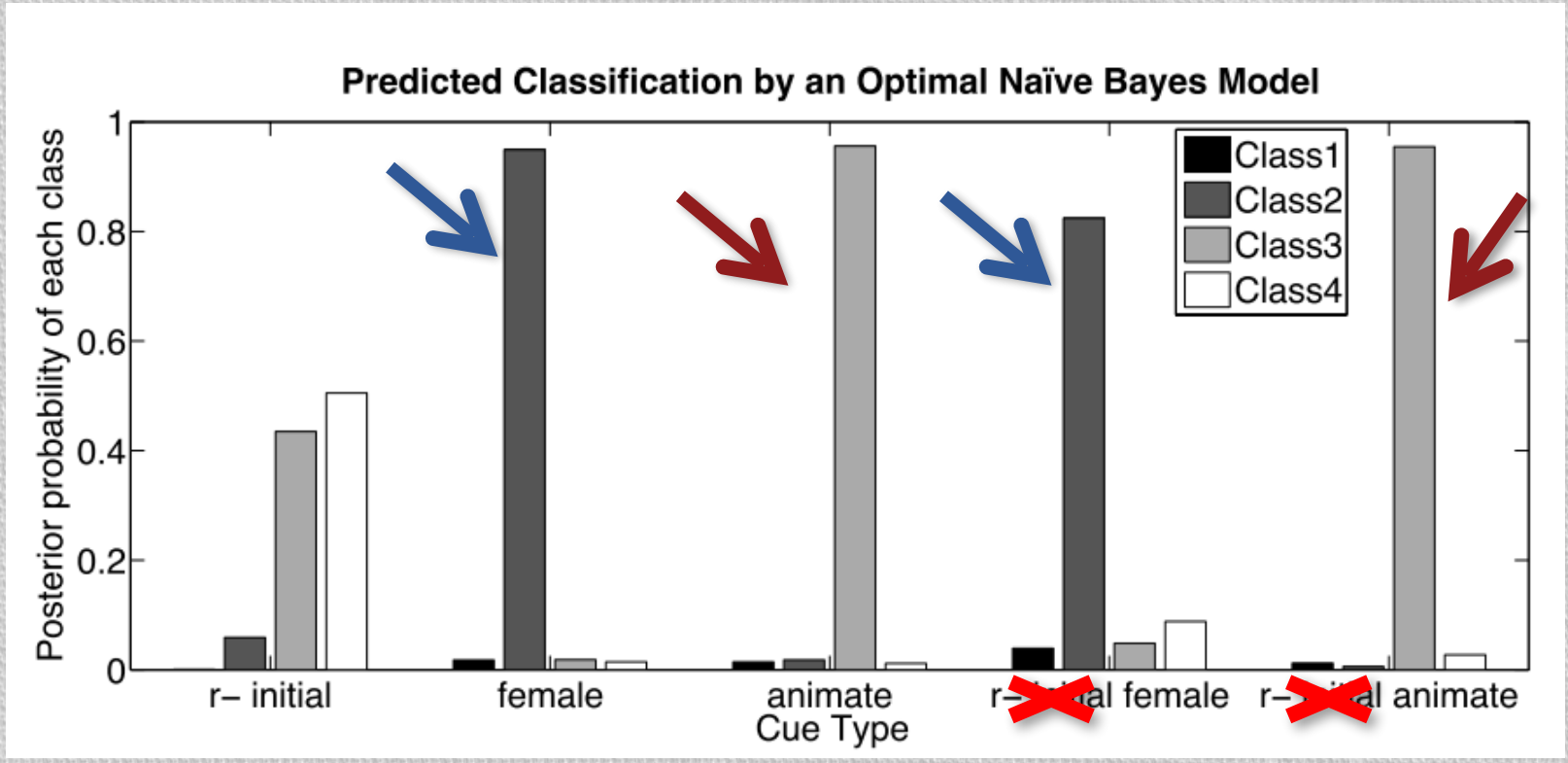
Optimal Bayesian Classifier Model

$$p\left(c \mid f_1, f_2 \ldots f_n\right) = \frac{p\left(f_1 \mid c\right)p\left(f_2 \mid c\right)\ldots p\left(f_n \mid c\right)p(c)}{\sum_i p\left(f_1 \mid c_i\right)p\left(f_2 \mid c_i\right)\ldots p\left(f_n \mid c_i\right)p(c_i)} \quad (1)$$

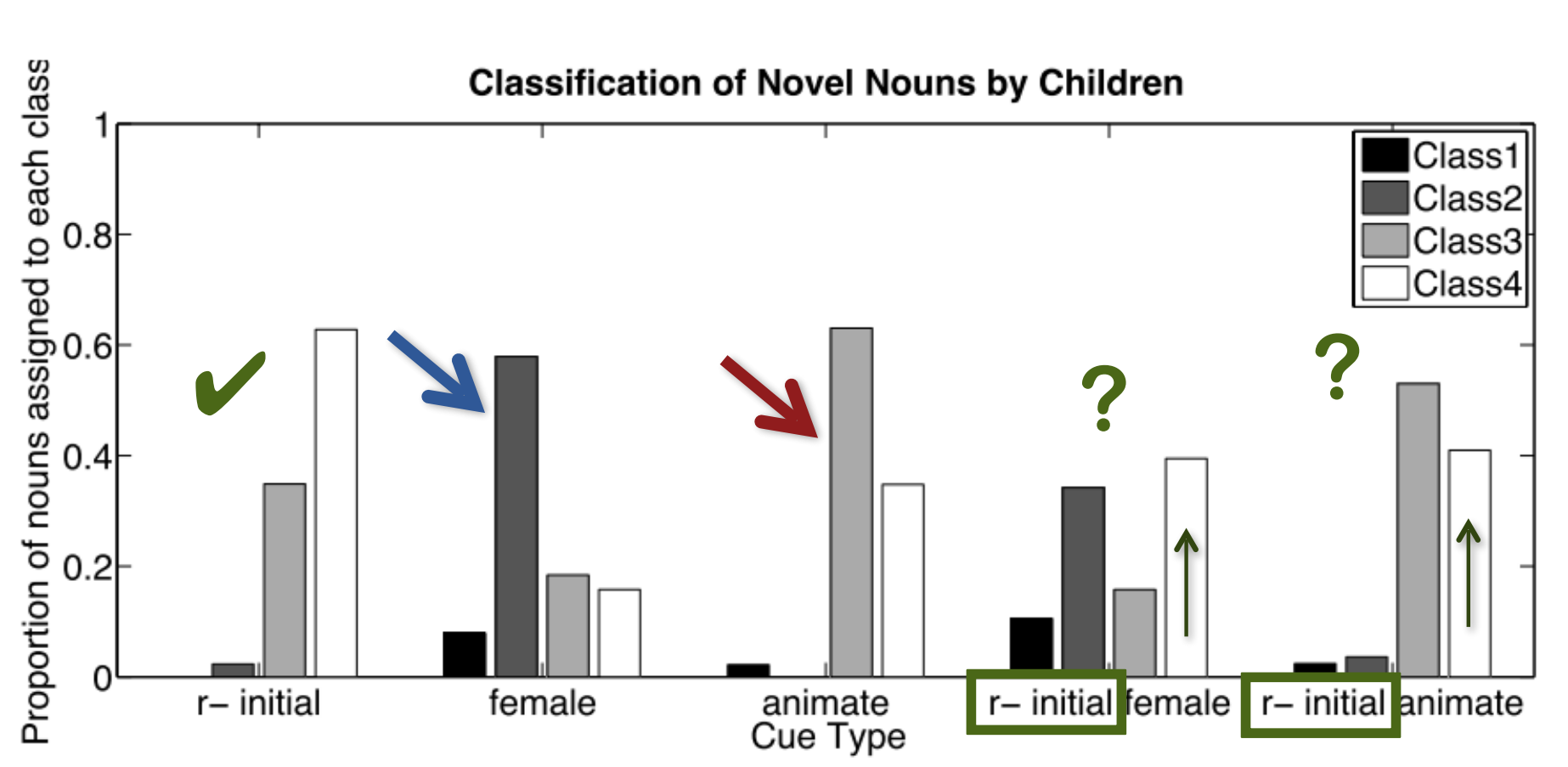


Optimal Bayesian Classifier Model

$$p(c \mid f_1, f_2 \ldots f_n) = \frac{p(f_1 \mid c)p(f_2 \mid c)\ldots p(f_n \mid c)p(c)}{\sum_i p(f_1 \mid c_i)p(f_2 \mid c_i)\ldots p(f_n \mid c_i)p(c_i)} \quad (1)$$



Children (age 4-6) Classification



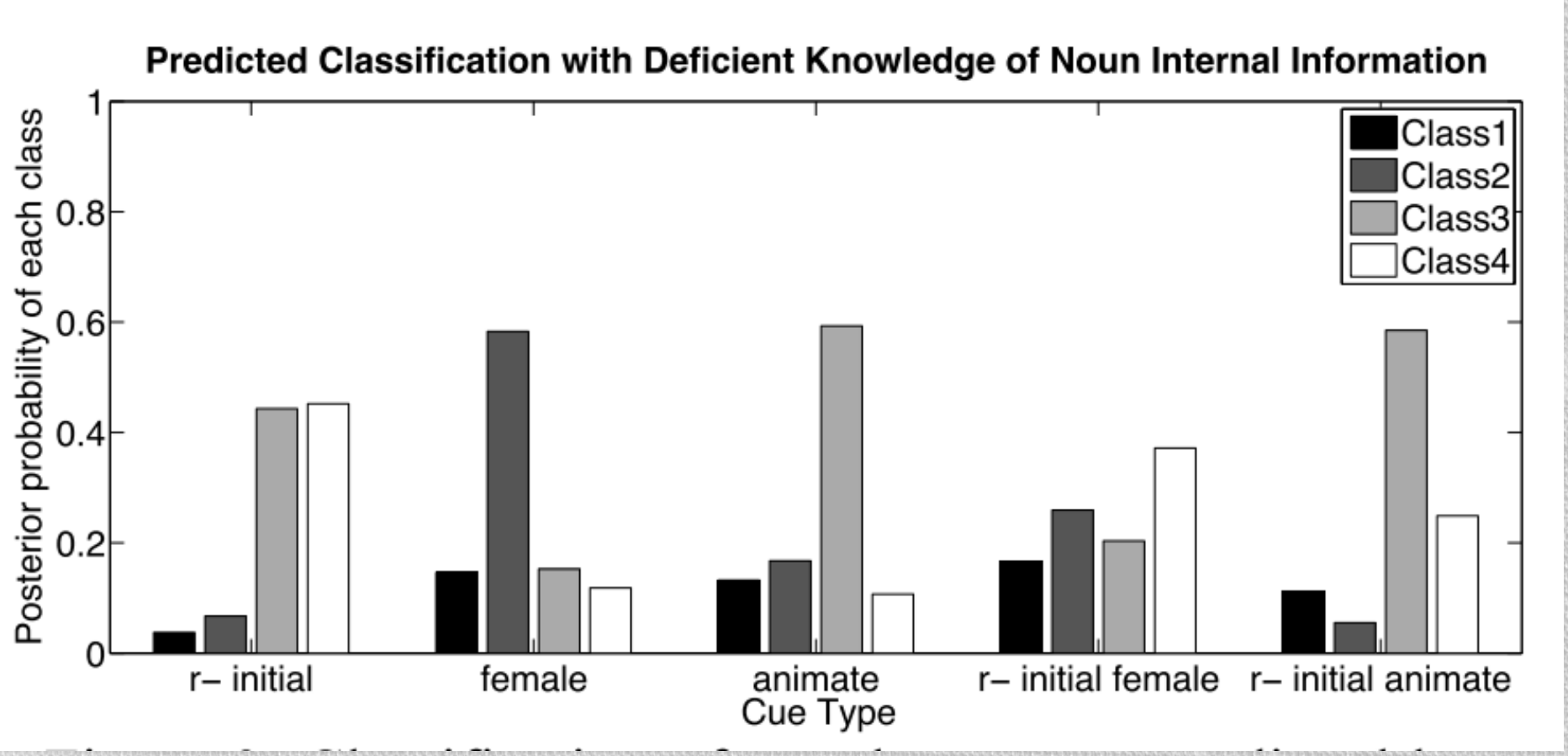
Why Sub-"Optimal" Classification?

- Hyp 1: Phonological and semantic features are not encoded with equal reliability
- Hyp 2: Experimental procedure produces weird results
- Hyp 3: Internal bias towards phonological features

Hyp 1: Semantic Incompetence

Likelihood term:

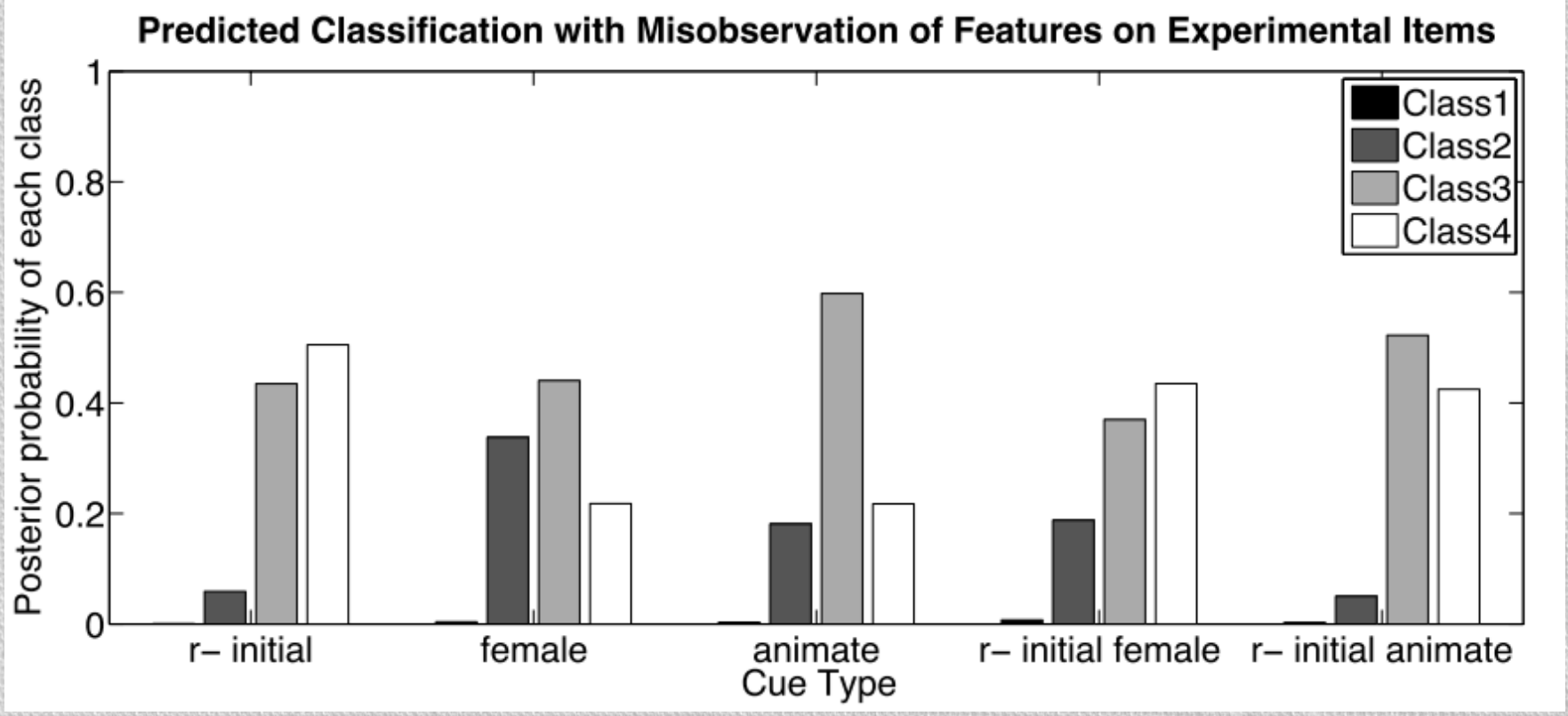
$$p(f = k \mid c) = \frac{N_{c,f=k} + 1}{N_c + K} \qquad (2)$$



Hyp 2: Experimental Reject

Equation:

$$p(c \mid f_1, f_2) = (1-\beta)\frac{p(f_1=[spe] \mid c)p(f_2 \mid c)p(c)}{\sum_i p(f_1=[spe] \mid c_i)p(f_2 \mid c_i)p(c_i)} + \beta\frac{p(f_1=[other] \mid c)p(f_2 \mid c)p(c)}{\sum_i p(f_1=[other] \mid c_i)p(f_2 \mid c_i)p(c_i)} \quad (3)$$



Hyp 3: Phonological Preference

Equation:

$$p\left(c \mid f_1, f_2\right) = (1-\beta)\frac{p\left(f_1 = [sem] \mid c\right)p\left(f_2 \mid c\right)p(c)}{\sum_i p\left(f_1 = [sem] \mid c_i\right)p\left(f_2 \mid c_i\right)p(c_i)} \quad (4)$$

$$+\beta\frac{p\left(f_2 \mid c\right)p(c)}{\sum_i p\left(f_2 \mid c_i\right)p(c_i)}$$