

Gender Differences in Lexical Input and Acquisition

Mika Braginsky, Stephan C. Meylan, Michael C. Frank
BUCLD 2016





Previous work

- Girls show an advantage in early vocabulary growth
(Doran, 1907; Nelson, 1973; Huttenlocher et al., 1991, 1989, Eriksson et al., 2012; Frank et al, 2016)
- Difference in vocabulary size attributable to more input to girls? (Cherry & Lewis, 1976, 1978; Halverson & Waldrop, 1970)
- Counterevidence: No difference in quantity of speech directed to girls and boys (Clarke-Stewart ,1973; Cohen and Beckwith, 1976)

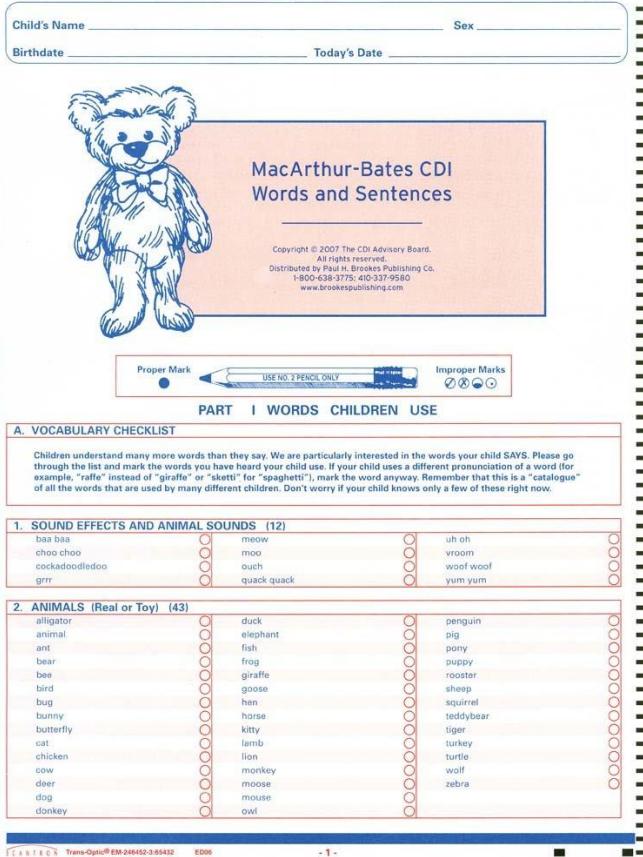
Approach

- Examine finer-grained links between environment and acquisition
- Focus on individual words
- Use large scale developmental data
- Characterize input and learning
- Look at the relationship between them at word level
(Goodman, Dale, Li, 2008; Roy et al 2015; Braginsky et al 2016)

Analysis Overview

- Estimate differences in acquisition trajectories
- Estimate differences in input lexical statistics
- Predict acquisition differences from input differences
- Extend acquisition analysis cross-linguistically
Croatian, Danish, English, French, Italian, Norwegian, Russian,
Spanish, Swedish, Turkish

Acquisition trajectories



- Words & Gestures (WG)
 - Comprehension and production
 - 8-18 months
 - 396 items
- Words & Sentences (WS)
 - Production
 - 16-30 months
 - 680 items
- Adapted to many languages

Acquisition trajectories



Wordbank

An open database of children's vocabulary development



6,433 English CDI administrations
3,120 **female**, 3,313 **male**
WS/WG, comprehension/production

Vocabulary NORMS

Explore vocabulary size growth curves for various languages and demographic groups.

ITEM TRAJECTORIES

Explore trajectories of individual words, word categories, and grammar items.

Admin Data

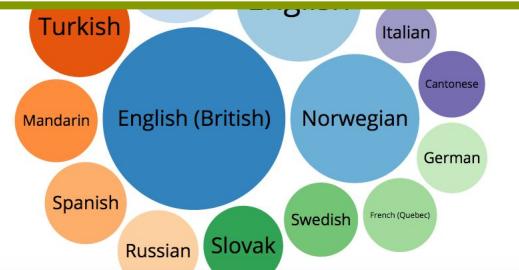
Download per-child vocabulary data.

Item Data

Download per-item acquisition data.

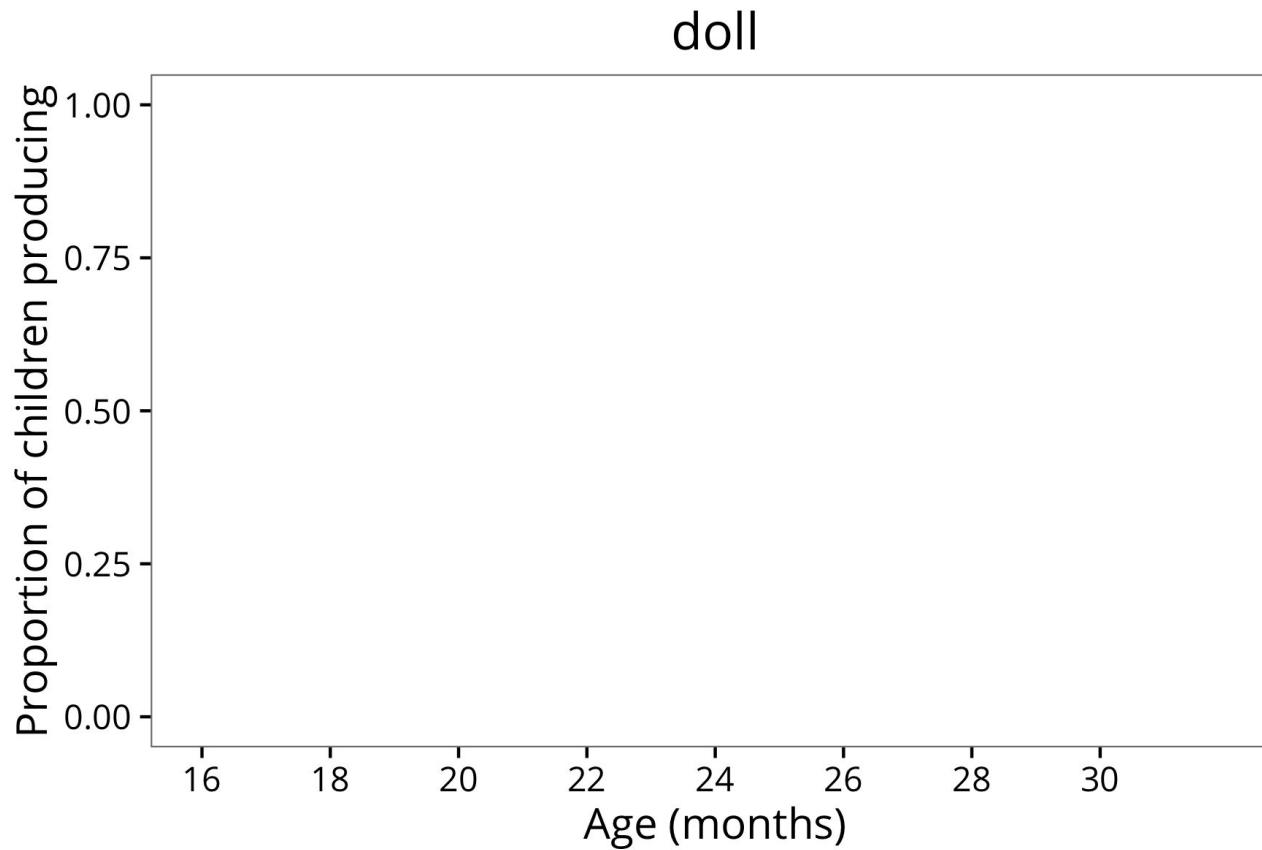
More Analyses

Ongoing research using Wordbank.

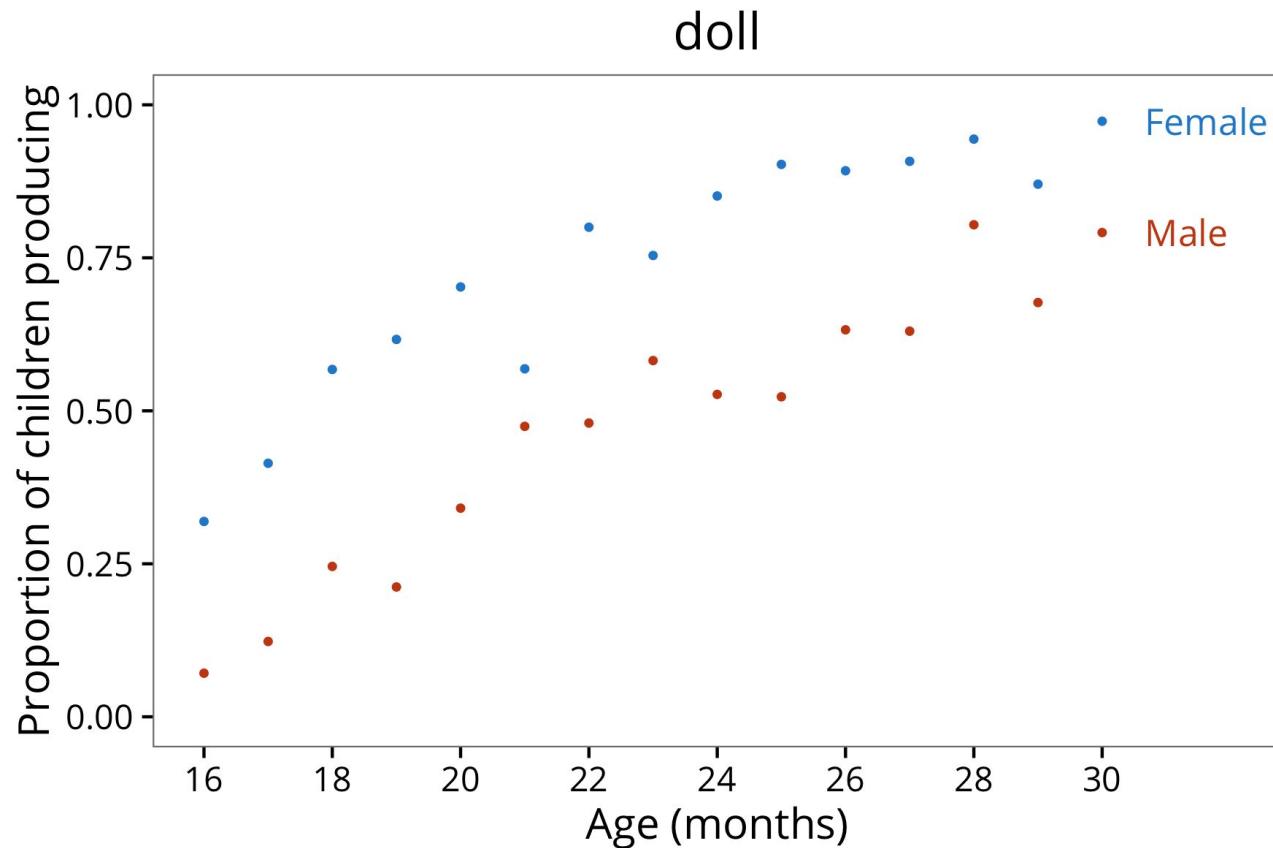


wordbank.stanford.edu

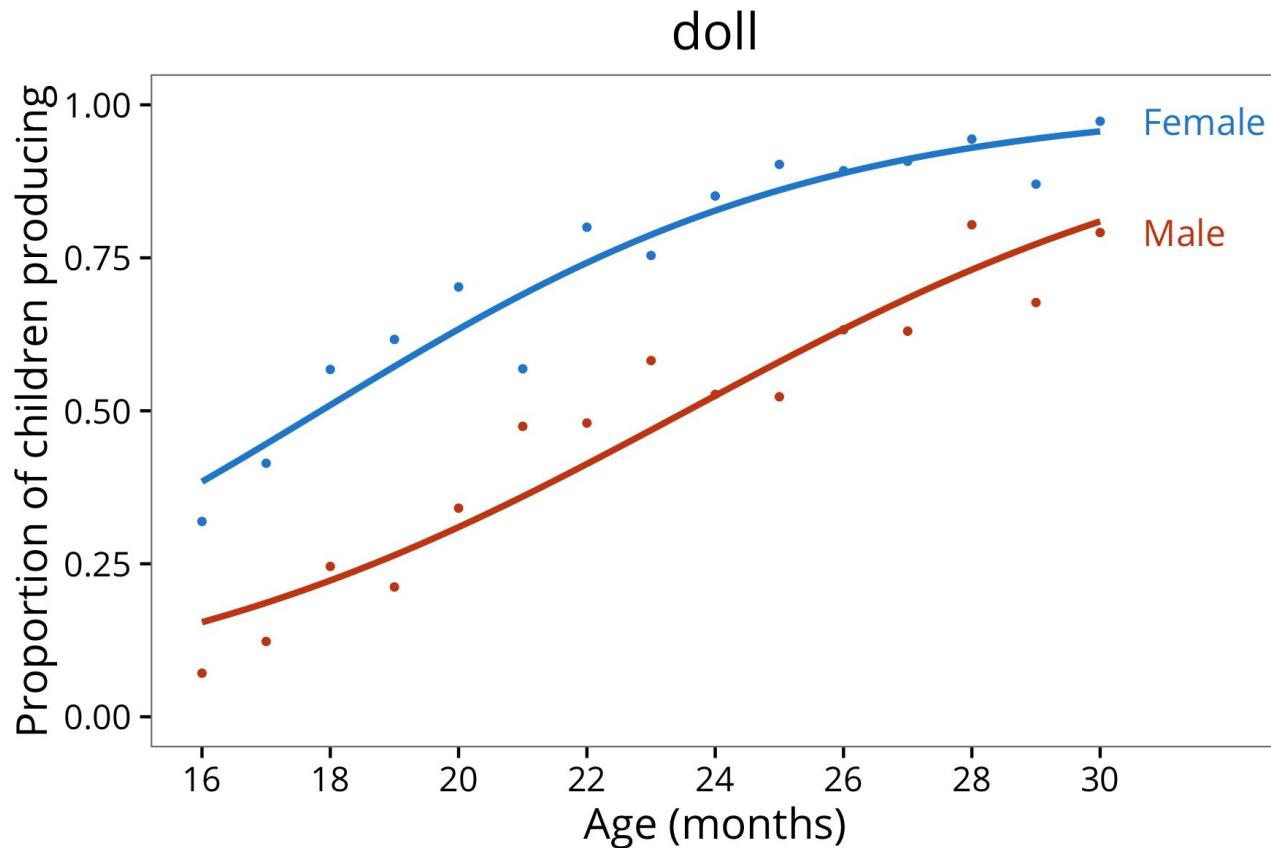
Acquisition trajectories



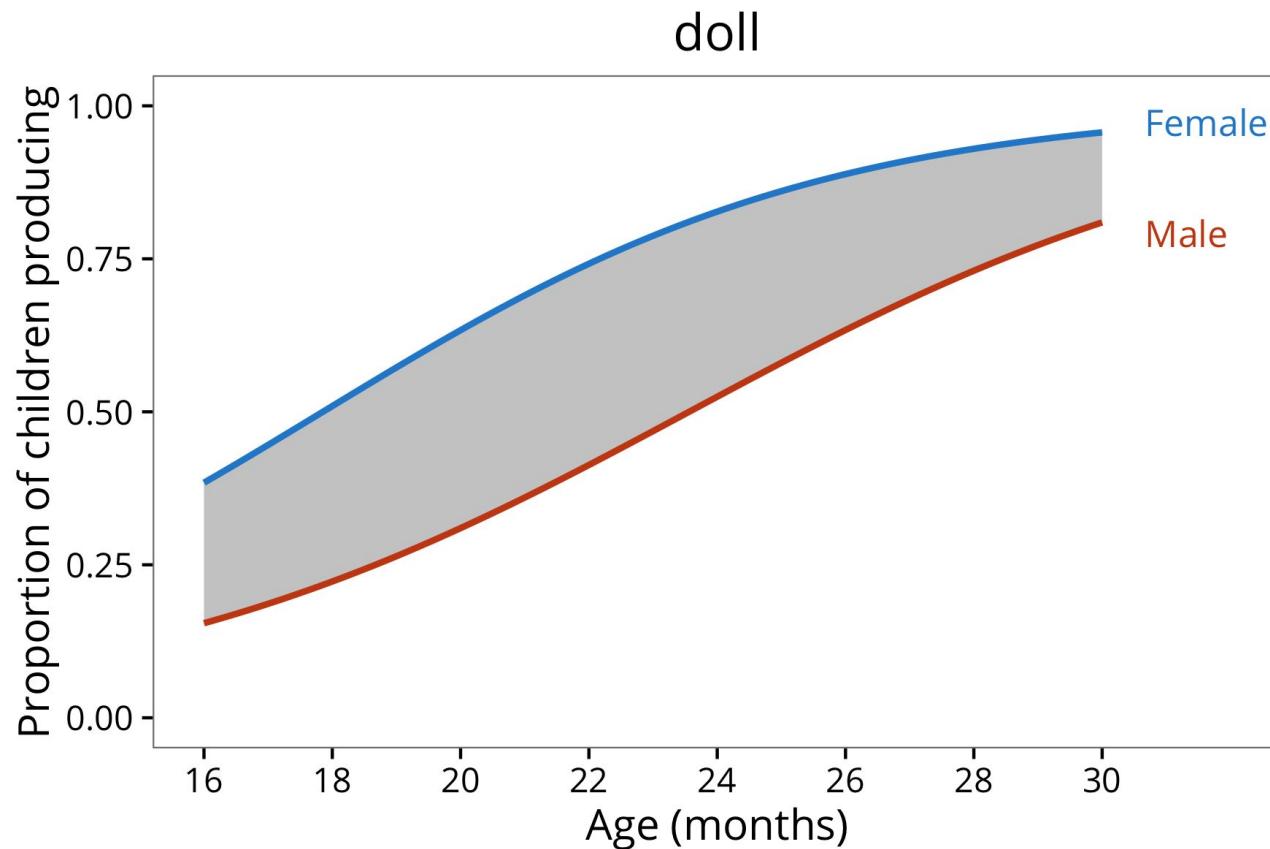
Acquisition trajectories



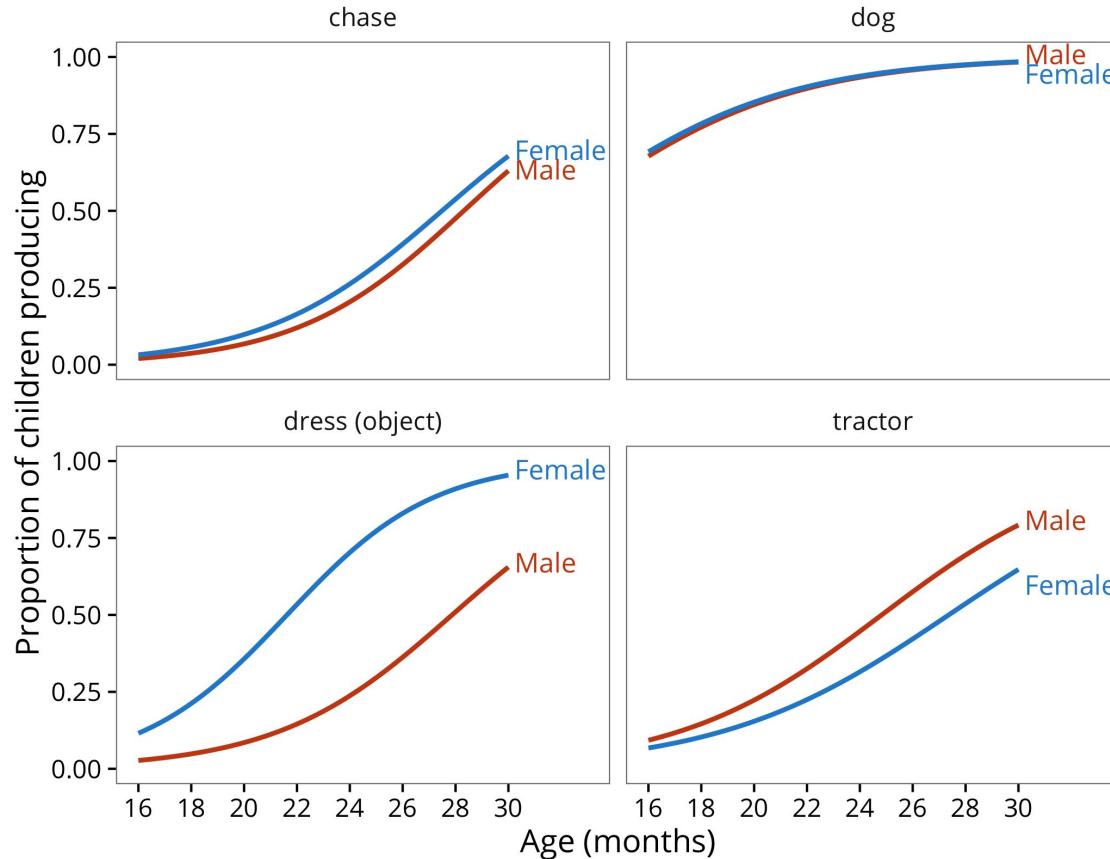
Acquisition trajectories



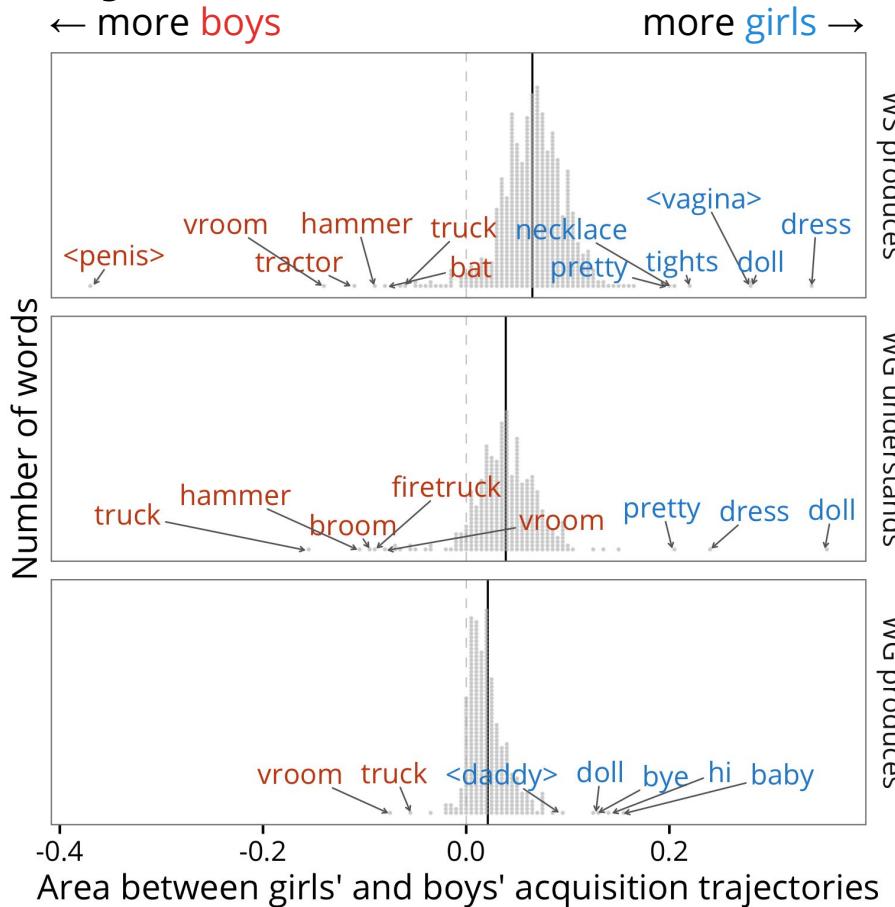
Acquisition trajectories



Acquisition trajectories



Acquisition trajectories



Input statistics

CHILDES Child Language Data Exchange System



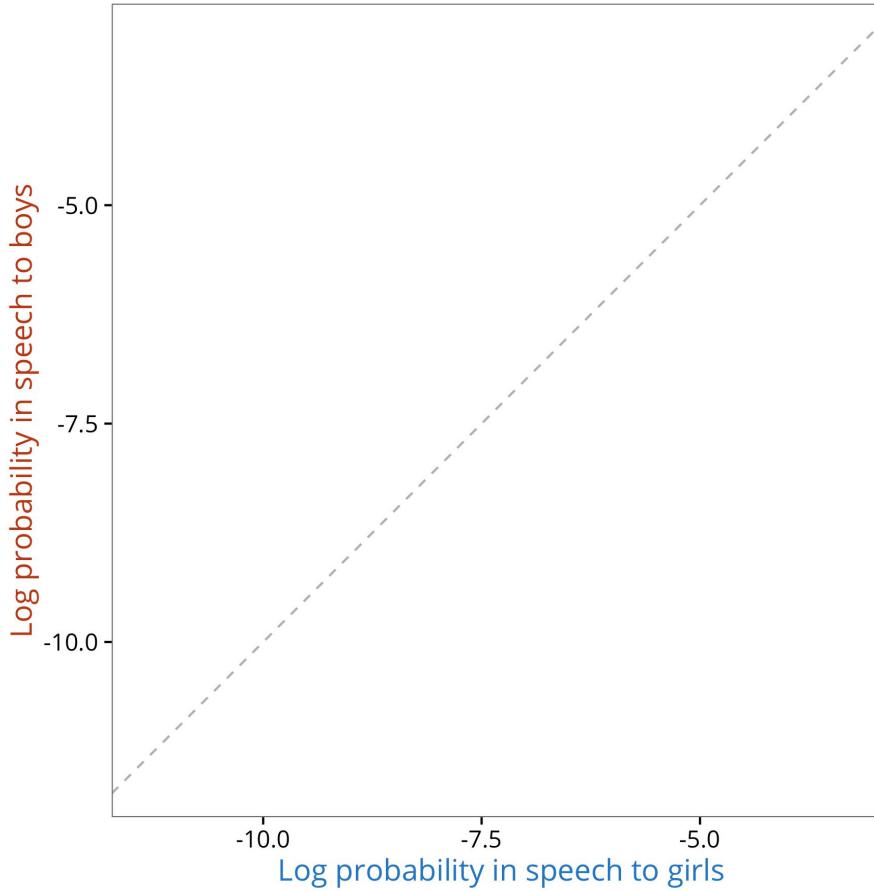
CHILDES is the child language component of the [TalkBank](#) system. TalkBank is a system for sharing and studying conversational interactions.

System	Database	Manuals
Ground Rules	Transcripts and Media - XML	CHAT Transcription
Contributing New Data	Browsable Database	CLAN Programs
IRB Principles	Derived Corpora and Counts	Database Manuals
Overviews and Introductions	The TalkBank Database	
Links	Programs	Contact
IASCL SemTalk	CLAN : Program - Manual - Tutorial	Brian MacWhinney : homepage
Other Child Language sites	SLP's Guide to CLAN and 中文	Joining Membership Lists
Research based on CHILDES	Chatter XML creator and validator	How to subscribe to Mailing Lists
	EVAL manual	
	Related Software	

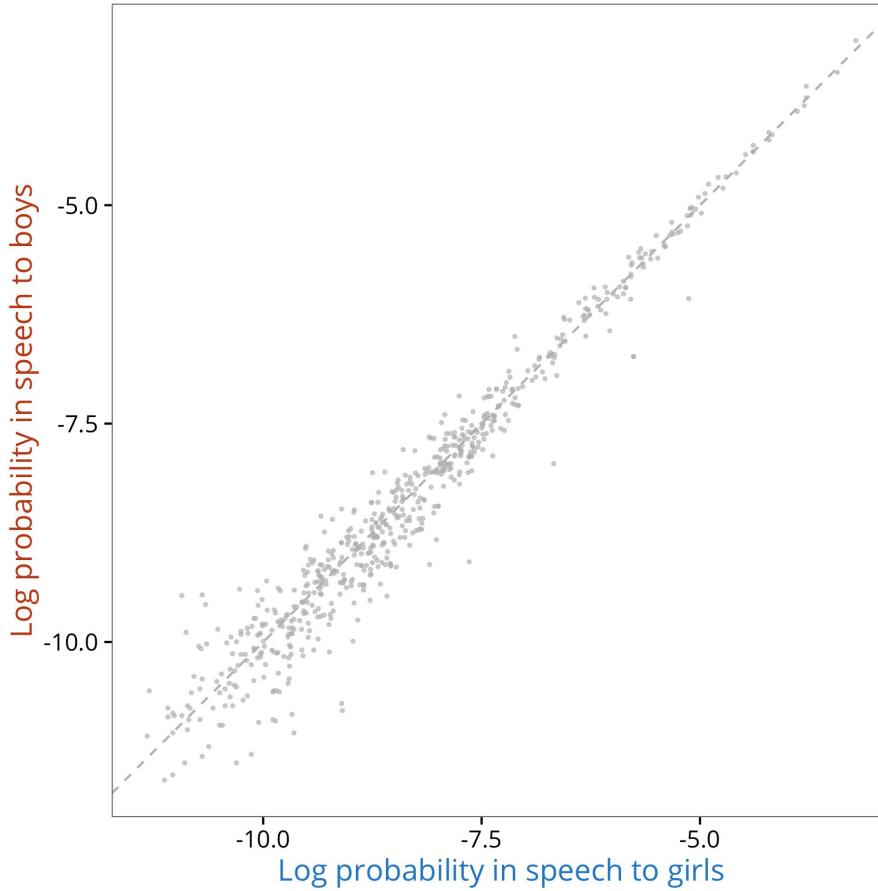
- All adult speech in English CHILDES corpora
- Frequency in girl-directed and boy-directed speech

(MacWhinney, 2000)

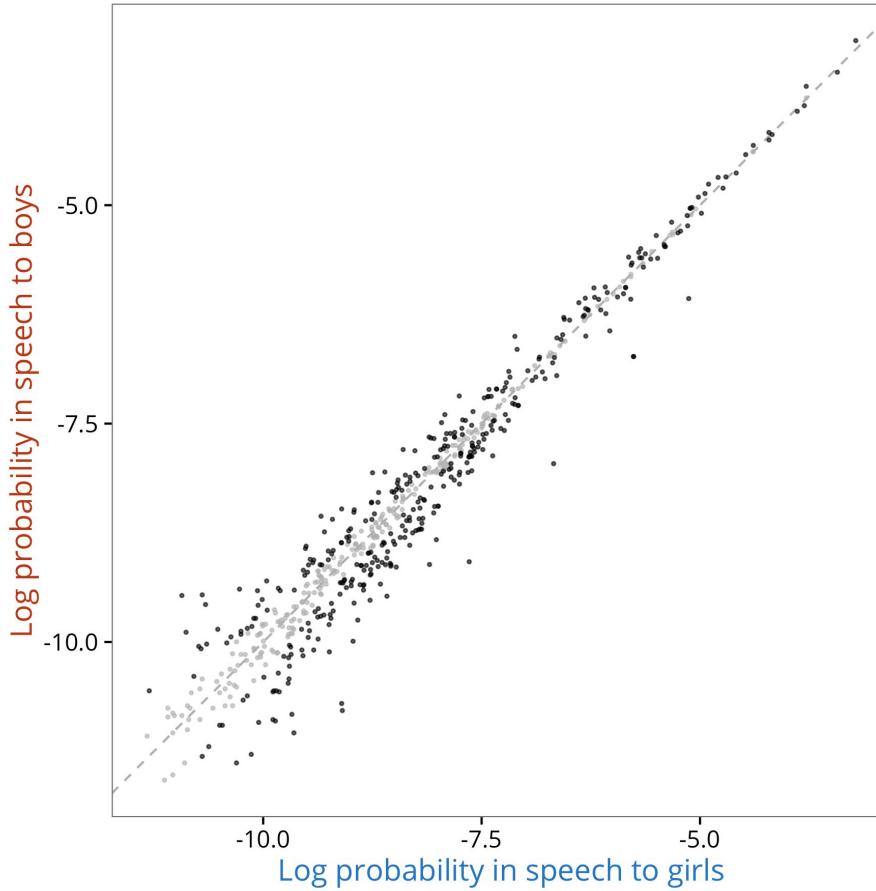
Input statistics



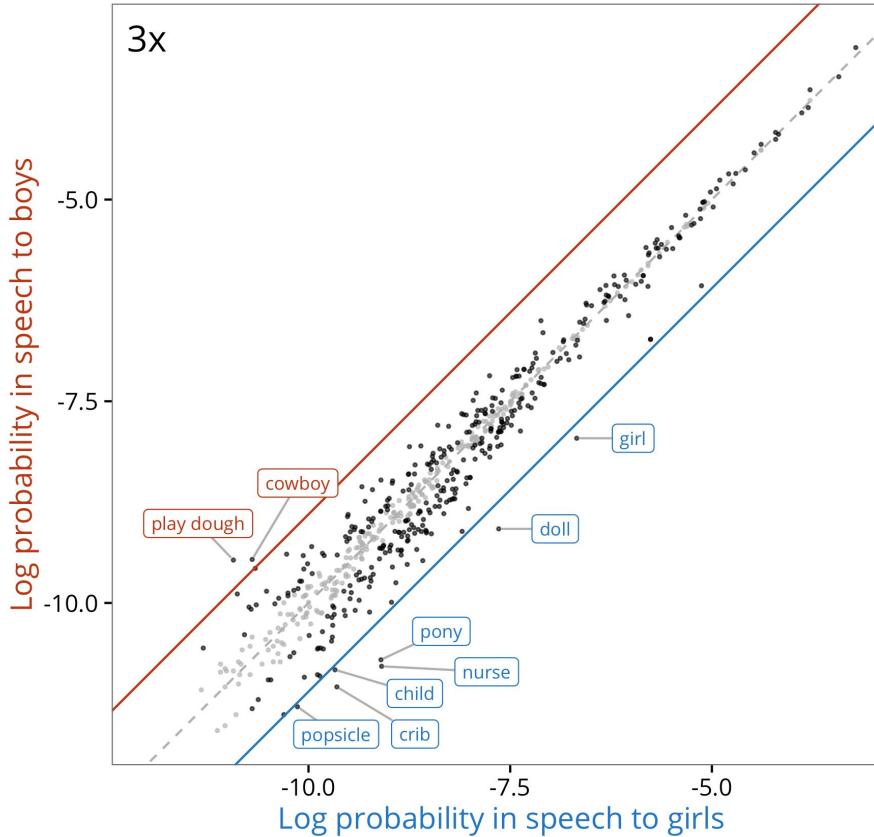
Input statistics



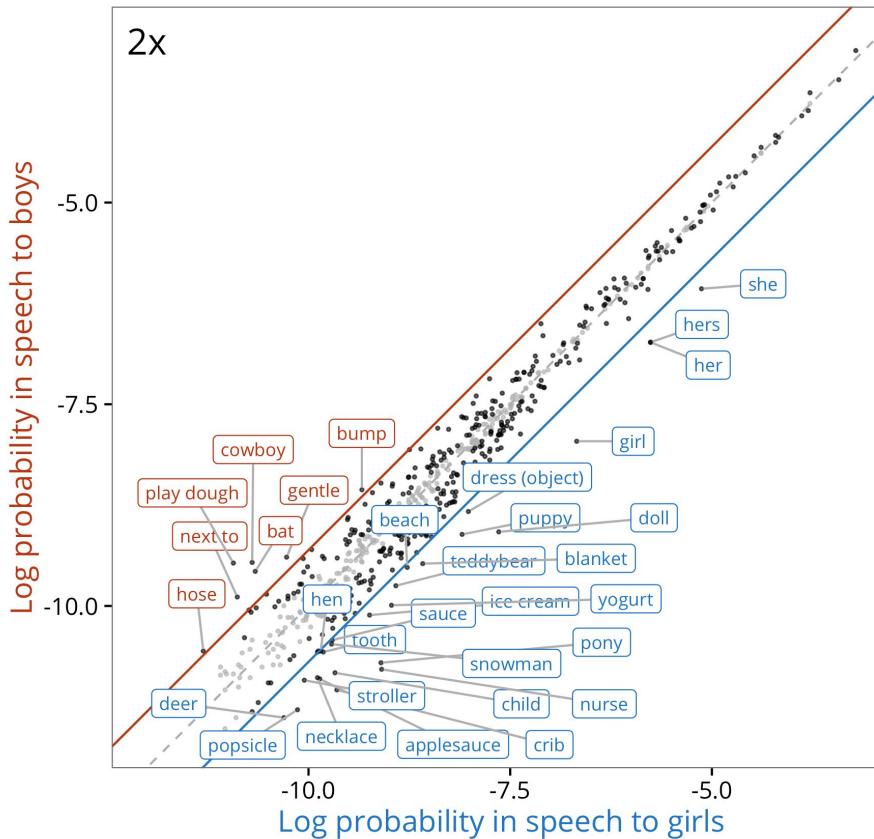
Input statistics



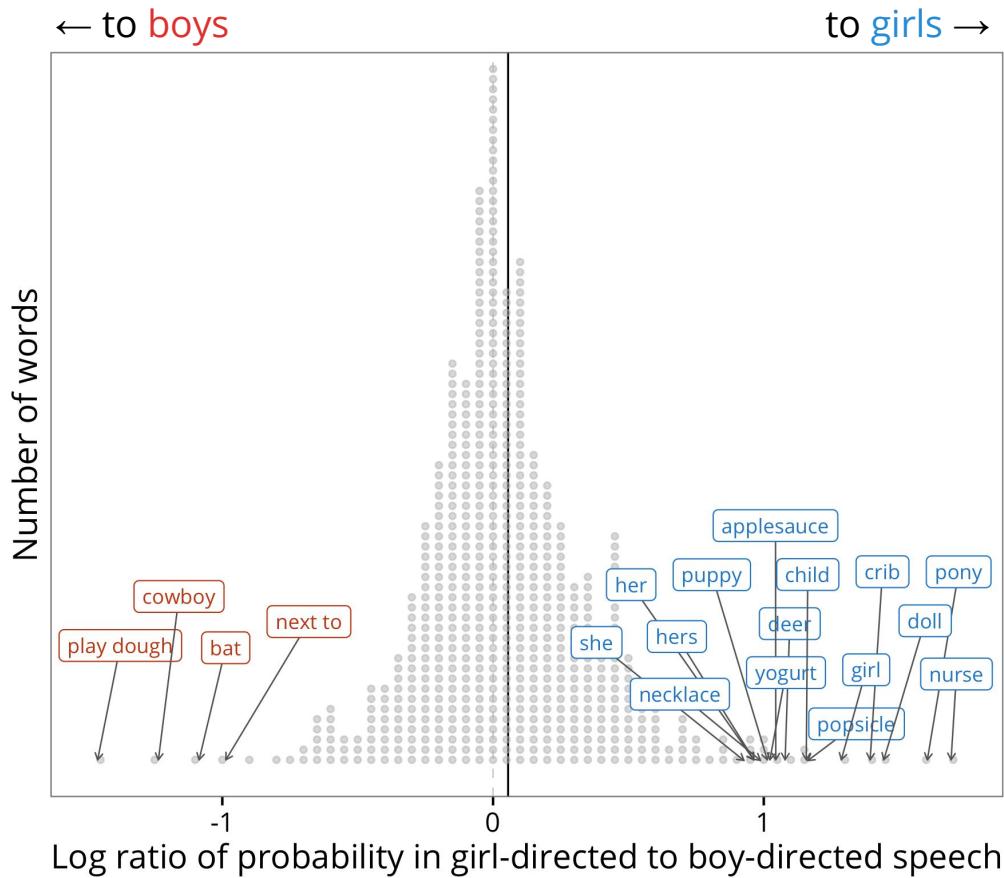
Input statistics



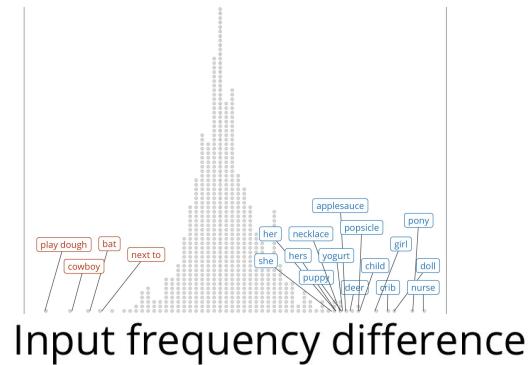
Input statistics



Input statistics

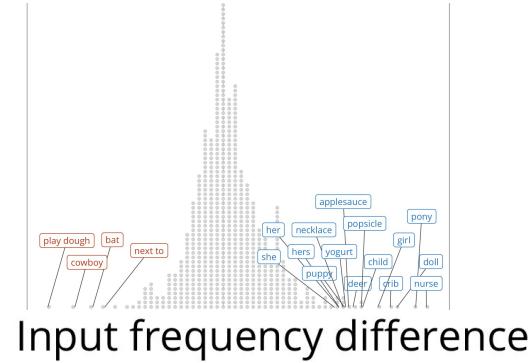
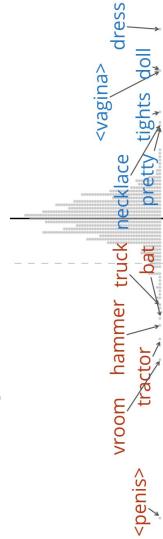


Input-acquisition relationship



Input-acquisition relationship

Acquisition difference

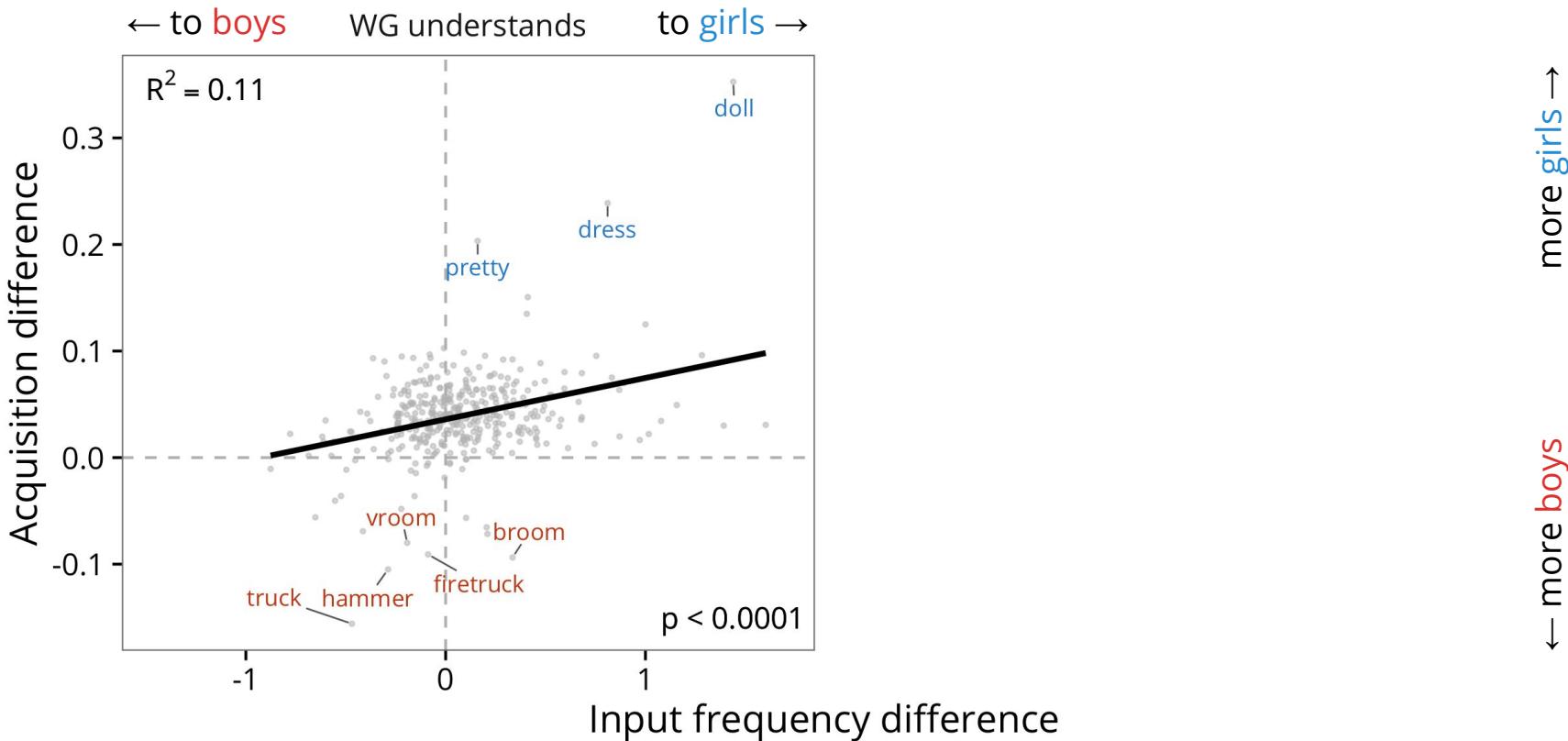


Input-acquisition relationship

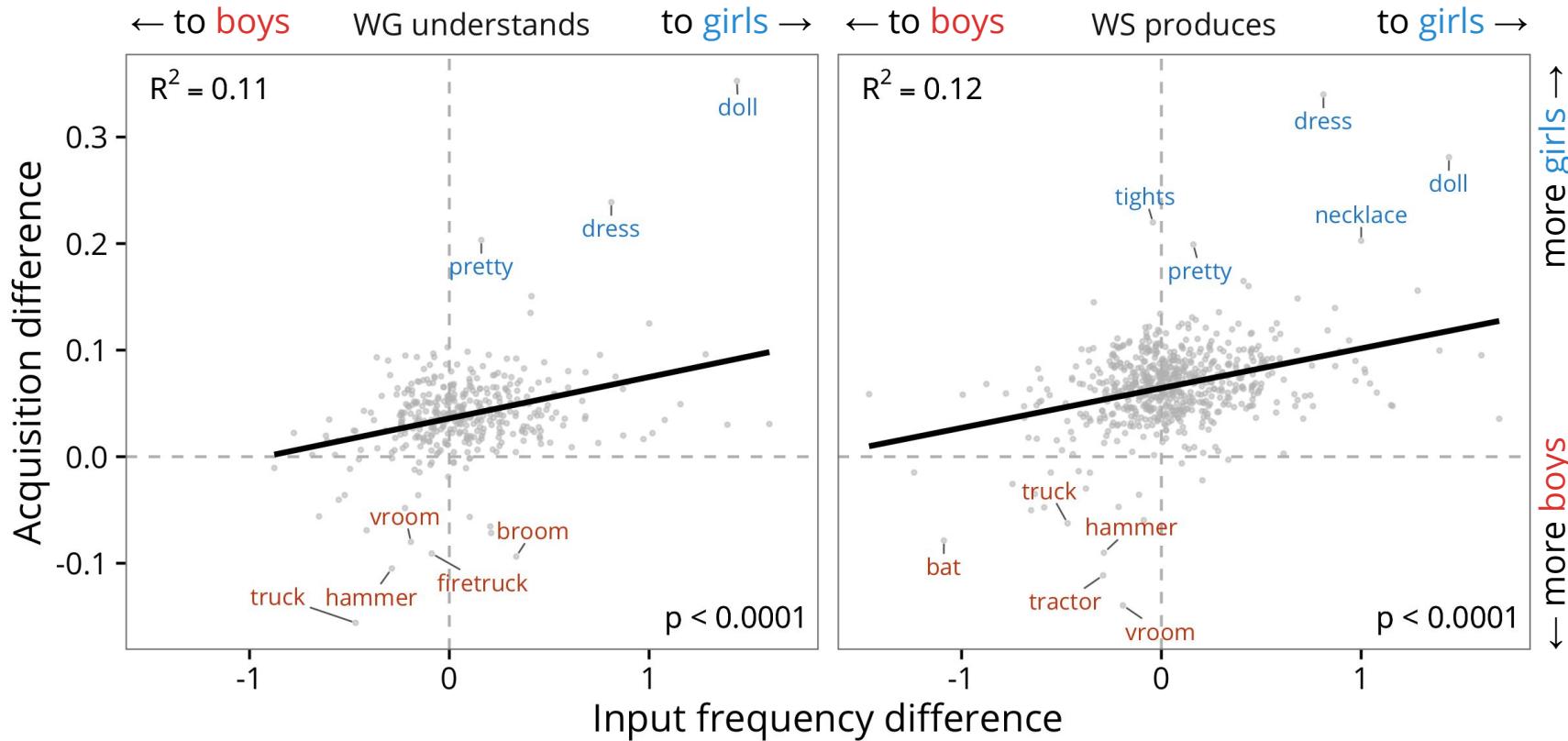
Acquisition difference

Input frequency difference

Input-acquisition relationship



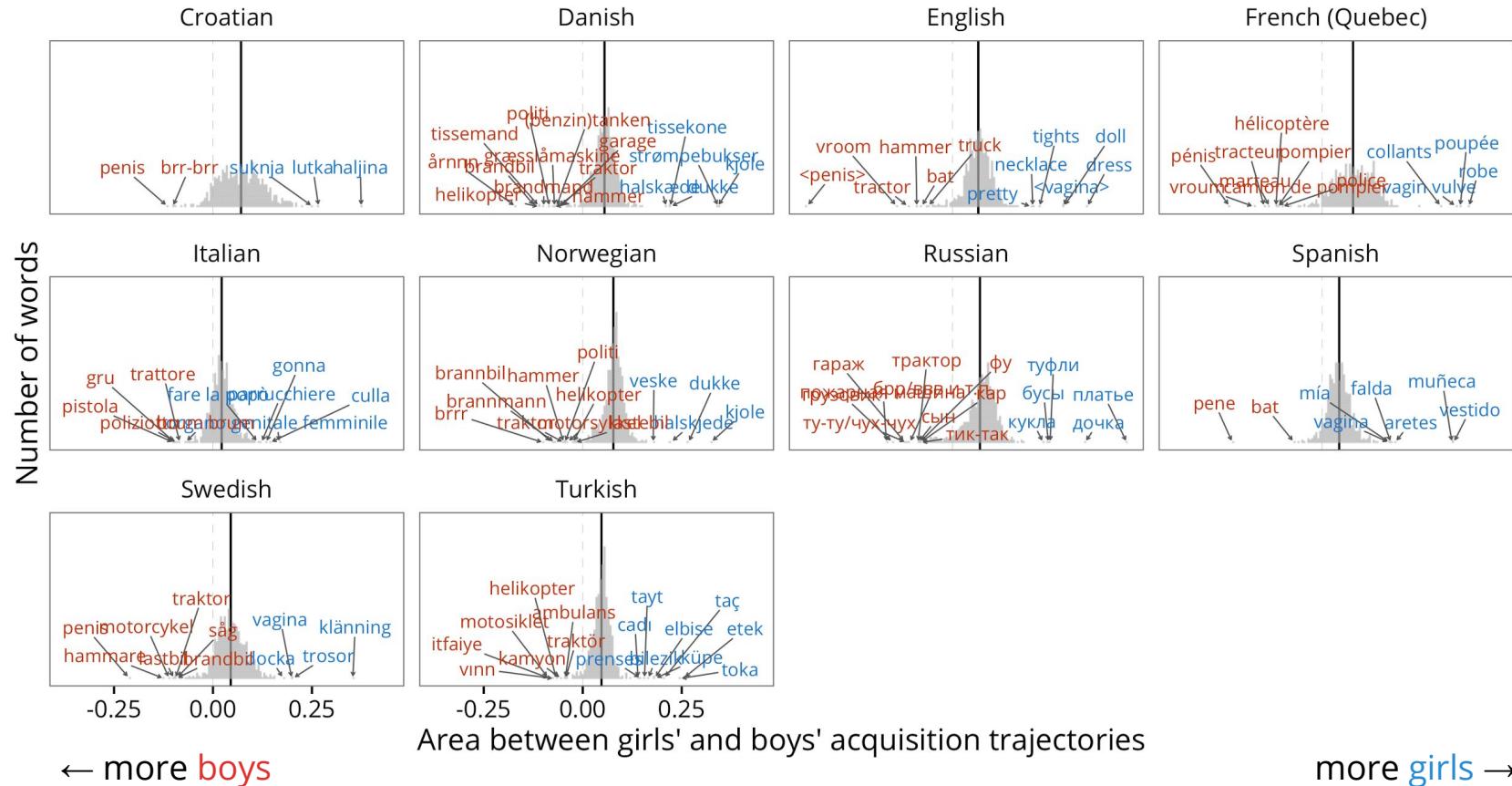
Input-acquisition relationship



Acquisition trajectories cross-linguistically

36,728 CDI administrations
over 10 languages
(min 627; max 12,225)
18,256 **female**, 18,472 **male**

Acquisition trajectories cross-linguistically



Acquisition trajectories cross-linguistically

dress	tights	dress	dress	vagina	dress	dress	dress	dress	skirt
doll	dress	doll	doll	crib	doll	daughter	doll	underpants	hairpin
skirt	doll	vagina	vagina	skirt	necklace	shoe	earrings	vagina	headband
stroller	vagina	tights	tights	hairdresser	purse	beads	skirt	doll	earrings
cry	necklace	necklace	necklace	go potty	potty	doll	mine	necklace	dress
pretty	underpants	pretty	underpants	necklace	pattycake	stroller	vagina	skirt	bracelet
plate	button	purse	girl	chips	brush	stroller	tights	shh	tights
comb	fine	underpants	purse	fawn	scarf	sweater	uncle	child's name	princess
handkerchief	go potty	girl	cheek	breast	bib	tissue	purse	button	naughty
paper	belly button	sweater	clean	doll	button	purse	necklace	butt	purse
Croatian	Danish	English	French (Quebec)	Italian	Norwegian	Russian	Spanish	Swedish	Turkish

girls > boys

Acquisition trajectories cross-linguistically

doll

dress	tights	dress	dress	vagina	dress	dress	dress	dress	skirt
doll	dress	doll	doll	crib	doll	daughter	doll	underpants	hairpin
skirt	doll	vagina	vagina	skirt	necklace	shoe	earrings	vagina	headband
stroller	vagina	tights	tights	hairdresser	purse	beads	skirt	doll	earrings
cry	necklace	necklace	necklace	go potty	potty	doll	mine	necklace	dress
pretty	underpants	pretty	underpants	necklace	pattycake	stroller	vagina	skirt	bracelet
plate	button	purse	girl	chips	brush	stroller	tights	shh	tights
comb	fine	underpants	purse	fawn	scarf	sweater	uncle	child's name	princess
handkerchief	go potty	girl	cheek	breast	bib	tissue	purse	button	naughty
paper	belly button	sweater	clean	doll	button	purse	necklace	butt	purse
Croatian	Danish	English	French (Quebec)	Italian	Norwegian	Russian	Spanish	Swedish	Turkish

girls > boys

Acquisition trajectories cross-linguistically

dress (object)

dress	tights	dress	dress	vagina	dress	dress	dress	dress	skirt
doll	dress	doll	doll	crib	doll	daughter	doll	underpants	hairpin
skirt	doll	vagina	vagina	skirt	necklace	shoe	earrings	vagina	headband
stroller	vagina	tights	tights	hairdresser	purse	beads	skirt	doll	earrings
cry	necklace	necklace	necklace	go potty	potty	doll	mine	necklace	dress
pretty	underpants	pretty	underpants	necklace	pattycake	stroller	vagina	skirt	bracelet
plate	button	purse	girl	chips	brush	stroller	tights	shh	tights
comb	fine	underpants	purse	fawn	scarf	sweater	uncle	child's name	princess
handkerchief	go potty	girl	cheek	breast	bib	tissue	purse	button	naughty
paper	belly button	sweater	clean	doll	button	purse	necklace	butt	purse
Croatian	Danish	English	French (Quebec)	Italian	Norwegian	Russian	Spanish	Swedish	Turkish

girls > boys

Acquisition trajectories cross-linguistically

clothing

dress	tights	dress	dress	vagina	dress	dress	dress	dress	skirt
doll	dress	doll	doll	crib	doll	daughter	doll	underpants	hairpin
skirt	doll	vagina	vagina	skirt	necklace	shoe	earrings	vagina	headband
stroller	vagina	tights	tights	hairdresser	purse	beads	skirt	doll	earrings
cry	necklace	necklace	necklace	go potty	potty	doll	mine	necklace	dress
pretty	underpants	pretty	underpants	necklace	pattycake	stroller	vagina	skirt	bracelet
plate	button	purse	girl	chips	brush	stroller	tights	shh	tights
comb	fine	underpants	purse	fawn	scarf	sweater	uncle	child's name	princess
handkerchief	go potty	girl	cheek	breast	bib	tissue	purse	button	naughty
paper	belly button	sweater	clean	doll	button	purse	necklace	butt	purse
Croatian	Danish	English	French (Quebec)	Italian	Norwegian	Russian	Spanish	Swedish	Turkish

girls > boys

Acquisition trajectories cross-linguistically

penis	vroom	penis	penis	gun	vroom	firetruck	penis	penis	motorcycle
vroom	firetruck	vroom	vroom	crane	firetruck	truck	bat	hammer	firetruck
was	helicopter	tractor	tractor	police	firefighter	garage	helicopter	motorcycle	vroom
truck	penis	hammer	hammer	tractor	hammer	choo choo	truck	truck	helicopter
tractor	firefighter	bat	helicopter	vroom	tractor	vroom	airplane	tractor	truck
motorcycle	police	truck	firetruck	soldier	police	tractor	firetruck	firetruck	ambulance
peekaboo	hammer	firetruck	firefighter	jeep	motorcycle	son	tractor	saw	tractor
him	lawn mower	motorcycle	police	barber	helicopter	yucky	hammer	screwdriver	hammer
that	gas station	dump	nail	motorcycle	truck	caw	ox	helicopter	gun
about	tractor	police	lawn mower	penis	train	tick tock	police	nail	robot
Croatian	Danish	English	French (Quebec)	Italian	Norwegian	Russian	Spanish	Swedish	Turkish

boys > girls

Acquisition trajectories cross-linguistically

tractor

penis	vroom	penis	penis	gun	vroom	firetruck	penis	penis	motorcycle
vroom	firetruck	vroom	vroom	crane	firetruck	truck	bat	hammer	firetruck
was	helicopter	tractor	tractor	police	firefighter	garage	helicopter	motorcycle	vroom
truck	penis	hammer	hammer	tractor	hammer	choo choo	truck	truck	helicopter
tractor	firefighter	bat	helicopter	vroom	tractor	vroom	airplane	tractor	truck
motorcycle	police	truck	firetruck	soldier	police	tractor	firetruck	firetruck	ambulance
peekaboo	hammer	firetruck	firefighter	jeep	motorcycle	son	tractor	saw	tractor
him	lawn mower	motorcycle	police	barber	helicopter	yucky	hammer	screwdriver	hammer
that	gas station	dump	nail	motorcycle	truck	caw	ox	helicopter	gun
about	tractor	police	lawn mower	penis	train	tick tock	police	nail	robot
Croatian	Danish	English	French (Quebec)	Italian	Norwegian	Russian	Spanish	Swedish	Turkish

boys > girls

Acquisition trajectories cross-linguistically

vehicles

penis	vroom	penis	penis	gun	vroom	firetruck	penis	penis	motorcycle
vroom	firetruck	vroom	vroom	crane	firetruck	truck	bat	hammer	firetruck
was	helicopter	tractor	tractor	police	firefighter	garage	helicopter	motorcycle	vroom
truck	penis	hammer	hammer	tractor	hammer	choo choo	truck	truck	helicopter
tractor	firefighter	bat	helicopter	vroom	tractor	vroom	airplane	tractor	truck
motorcycle	police	truck	firetruck	soldier	police	tractor	firetruck	firetruck	ambulance
peekaboo	hammer	firetruck	firefighter	jeep	motorcycle	son	tractor	saw	tractor
him	lawn mower	motorcycle	police	barber	helicopter	yucky	hammer	screwdriver	hammer
that	gas station	dump	nail	motorcycle	truck	caw	ox	helicopter	gun
about	tractor	police	lawn mower	penis	train	tick tock	police	nail	robot
Croatian	Danish	English	French (Quebec)	Italian	Norwegian	Russian	Spanish	Swedish	Turkish

boys > girls

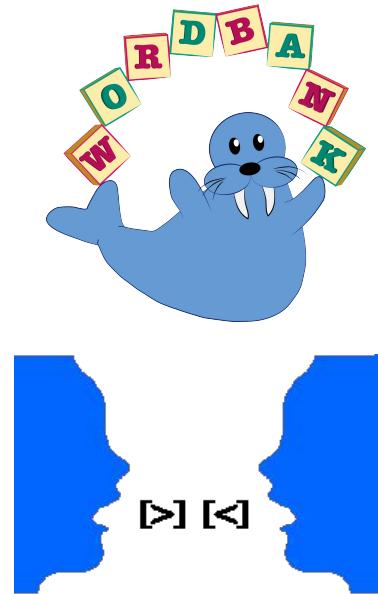
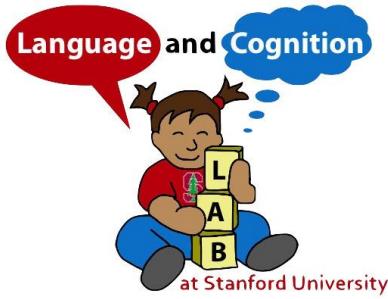
Future directions

- Lexical statistics cross-linguistically
- More nuanced input measures
 - Lexical context
 - Sentence structure
 - Speaking style
- Change over development
- Interaction with other variables (e.g. SES, birth order, parent gender, sibling gender)

Takeaways

- For many child-relevant words, parents use them significantly more when talking to girls vs. boys
 - ...almost all among nouns
- Similarly, many words are learned more by girls/boys
 - ...shifted towards girls
- These input and acquisition differences are related
- Across ten languages, similar meanings are girl/boy skewed
 - ...predominantly gendered toys and clothes

Thank you!



All data and code are available at
github.com/mikabr/gender-input

Log likelihood ratio

$$p_1 = \frac{k_1}{n_1} \quad p_2 = \frac{k_2}{n_2} \quad p = \frac{k_1 + k_2}{n_1 + n_2}$$

$$\Lambda = \frac{B(k_1; n_1, p)B(k_2; n_2, p)}{B(k_1; n_1, p_1)B(k_2; n_2, p_2)}$$

$$-2 \log \Lambda \sim \chi^2$$