Emergent noun faithfulness in novel English blends

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Overview

- English speakers show **emergent effects of noun faithfulness** in experiments where they must match novel blends to definitions manipulating noun/verb status
- Implications: (a) NFaith constraints are **available** even if not learned from L1 data
  (b) **Emergent effects** of NFaith may differ from **typological patterns**

1. Lexical blends as a testing ground for emergent effects

(1) **Emergent effect**: in an OT-type framework, a constraint or ranking **reveals itself**

(2) Term originates from "*emergence of the unmarked*" (McCarthy & Prince 1994)
  (a) A low-ranking (markedness) constraint *becomes visible* in a specific context
    • Reason: Higher-ranked competing constraints are not relevant there
  (b) Example: No codas in reduplication if MAX-IO >> NOCODA >> MAX-BR

(3) Emergent effects of **hidden** or **covert rankings**
  (a) Rankings **with no discernable effect in L1 phonology**
  (b) Their effects emerge when speakers **perform non-L1 tasks**
  (c) Theoretically significant because:

> Emergent effects of covert rankings reveal phonological knowledge that **was not learned directly** from the ambient language data

(4) Emergent **covert rankings** as in (3) have been found in:
  (a) L2/interlanguage (e.g., Broselow, Chen, & Wang 1998; Zhang 2013; Jesney to appear)
  (b) Lab production/perception of non-L1 structures (Davidson 2001, Berent et al. 2007; cf. Davidson 2010); loanwords (Jacobs & Gussenhoven 2000; Ito & Mester 2001)
  (d) Language games (Moreton, Feng, & Smith 2008)

(5) **Lexical blends** are a testing ground for emergent effects (Shaw 2013, Shaw et al. 2014)
  (a) Lexical blend: (Intentional) word-formation process
    • Combines two or more source words, as in *sp(oon)* + (f)ork → *sp*ork
  (b) Often involves truncation—loss of input material: [s p ~~ʊ n f~~ ɔ ɹ k]
  (c) **Emergent effects**: Do phonological factors that are **not** active in the non-blend phonology influence what source-word material is lost vs. preserved?

2. Noun faithfulness and lexical blends

(6) There is *typological* evidence for **noun faithfulness** (Smith 2011)

(a) Noun (N) phonology can be different from verb (V) phonology

(b) In such cases, if one category shows special faithfulness, it is typically N

- Special faithfulness = resistance to alternations; more contrasts

(7) Implementation: Faithfulness constraints can be **indexed** to the category N

- This makes noun faithfulness a subtype of positional faithfulness (Beckman 1999)
- On constraints indexed to lexical sets, see also (e.g.) Ito & Mester (1999, 2001); Pater (2010)

(a) MaxSeg(N) — Assign one * to each input segment in a N that has no output correspondent (= No segment deletion from N)

(b) MaxStress(N) — Assign one * to each input stress in a N that has no output correspondent (= No stress deletion from N)

→ Non-nouns always satisfy (vacuously) any constraint indexed to N

(8) We argue (see §5) that MaxSeg(N) and MaxStress(N) **are not active** in English

- This makes them relevant for testing for **emergent effects** in blends

(9) Structure of experiments:

1–2 NounFaith | segmental, stress preservation

3–4 HeadFaith | segmental, stress preservation—comparison case (from Shaw 2013)

2.1 Experiments 1 and 2: Noun faithfulness

(10) If noun faithfulness affects blend formation, then **properties of a N source word** should be **better preserved** in a blend than those of a V source word

(11) Experiment materials: Blends that will test for effects of NounFaith

- This is an extension of the blend experiment methodology in Shaw (2013)

(a) Each source-word pair can be **blended in two different ways**

Exp 1—Two different **segment** choices: plot+*litigate* → plo*tigate*, p*litigate*

Exp 2—Two different **stress** choices: fúdge+rejéct → fúdgect, fudgéct

(b) The first source word is **ambiguous between N and V** (second always used as V)

plot	N: 'the storyline of a book, etc.'	V: 'to make secret plans'
fudge	N: 'a type of confection'	V: 'to adjust dishonestly'

- Ambiguous N/V words = **homophones**, differing significantly in meaning

Homophones: *To fudge* / *the fudge*
Not homophones: *To bike* / *the bike*

(c) **Two definitions** are provided for the blend, using the N and V meanings

plot + *litigate*	N+V	to sue a plagiarist over the plot of a novel
	V+V	to sue a conspirator when they plot against you
fudge + *reject*	N+V	to refuse to eat any fudge
	V+V	to refuse to fudge a calculation

(12) Prediction: **If NounFaith influences blend formation**, participants will match...
  (a) the output blend that is **more faithful** to the first source word to
  (b) the definition that uses the first source word as a **noun**

(13) Exp 1: Prediction for **MaxSeg(N)**

		Possible pairing of *blend → definition*	***NounFaith:* MaxSeg(N)**	*HeadFaith:* MaxSeg(Hd)	Output stress constraints
►	(a) *i.*	[**plɑt**ɨgeɪt] → **N**+V	*(faithful)*	*	*same*
	ii.	[plɪtɨgeɪt] → V+V	*(vacuous)*		*same*
	(b) *i.*	[plɑtɨgeɪt] → V+V	*(vacuous)*	*	*same*
	ii.	[**plɪt**ɨgeɪt] → **N**+V	***!**		*same*

(14) Exp 2: Prediction for **MaxStress(N)**

		Possible pairing of *blend → definition*	***NounFaith:* MaxStress(N)**	*HeadFaith:* MaxStress(Hd)	Output stress (V prefers iamb?)
►	(a) *i.*	f**ú**dgect → **N**+V	*(faithful)*	*	(*)
	ii.	fudgéct → V+V	*(vacuous)*		
	(b) *i.*	fúdgect → V+V	*(vacuous)*	*	(*)
	ii.	f**u**dgéct → **N**+V	***!**		

2.2 Experiments 3 and 4: Comparison case—Head faithfulness

(15) Comparison case: A (modified) replication of Shaw (2013)
  (a) Shaw discovered emergent effects of faithfulness to *heads* in English blends
  (b) Developed the experimental paradigm we are using
  (c) Some differences in experiment design (see §3)

	Shaw (2013)	Our replication
Number of items	8	9
Subject recruitment	Networking	Mechanical Turk
Web interface	Radio buttons	Drag-and-drop

(16) Reasons for including a replication of Shaw's HeadFaith experiments
  (a) Allows us to confirm that our revised methodology is sensitive to emergent effects of positional faithfulness in blend formation by English speakers
  (b) Allows a tentative comparison between NounFaith, HeadFaith effect size

(17) Structure of HeadFaith materials (exact items from Shaw 2013, plus one new item each)

(a) Each source-word pair can be **blended in two different ways**

Exp 3—Two different **segment** choices: flamingo+*mongoose* → flam*ingoose*, fla*mongoose*

Exp 4—Two different **stress** choices: flóunder+sardíne → flóundine, floundíne

(b) Controlled for lexical category: All source words are used as N

(c) **Two definitions** are provided; one is **right-headed** and one is **coordinating**

flamingo+mongoose	(coordinating)	a hybrid of a mongoose and a flamingo
	(right-headed)	a mongoose that preys on flamingos
flounder+sardine	(coordinating)	a cross between a sardine and a flounder
	(right-headed)	a type of sardine eaten by flounder

(18) Prediction: **If HeadFaith influences blend formation**, participants will match...

(a) the output blend that is **more faithful** to the second source word to

(b) the definition that uses the second source word as a **head**

→ Shaw (2013) found a significant effect of HeadFaith for both segmental and stress preservation

3. Experiments: Design, methodology, participant demographics

3.1 Stimulus design

(19) Segmental preservation (Exp 1, 3)

- Each source word pair has two possible switchpoints: C_1__C_2 around main-stress vowel
- Example: *plot* + *litigate* = *plotigate*, *plitigate*

p l á t
l í t ɪ g e ɪ t

(20) Stress preservation (Exp 2, 4)

- Source word 1 has initial stress; source word 2 has final stress (some are monosyllables)
- Switchpoint is a C that follows ˈV in wd1, precedes ˈV in wd2
- Example: *fudge* + *reject* = *fúdgect*, *fudgéct*

f ʌ́ ʤ
ɹ ɨ ʤ é k t

3.2 Experiment design

(21) Web-based experiments

- Used a modified version of the Experigen software (Becker 2013)

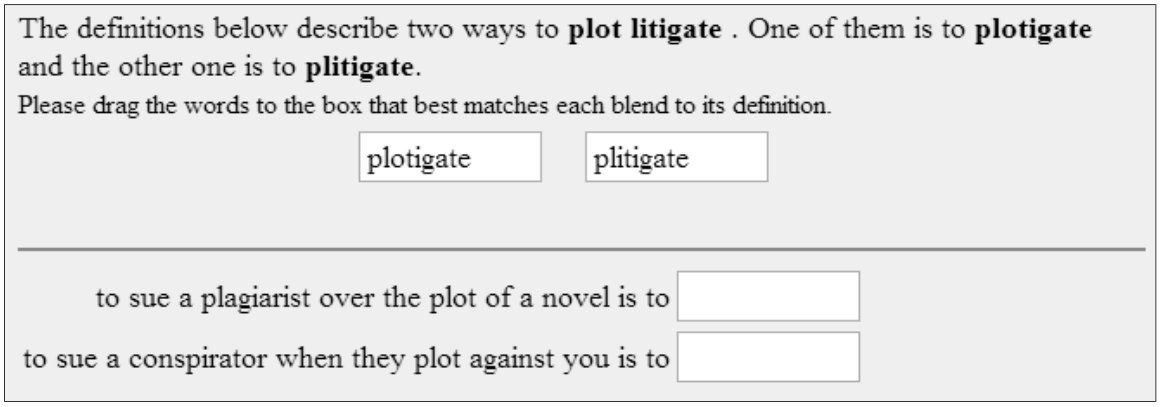
(22) Web interface was drag-and-drop

(a) Participants saw a pair of blends and a pair of definitions
- Blends differed in segmental / stress properties
- Definitions differed by lexical category or headedness factors

(b) Participants were asked to click on a blend, drag it to the best-matching definition

(23) Example: Segmental blend (Exp 1, 3)

- Presented orthographically



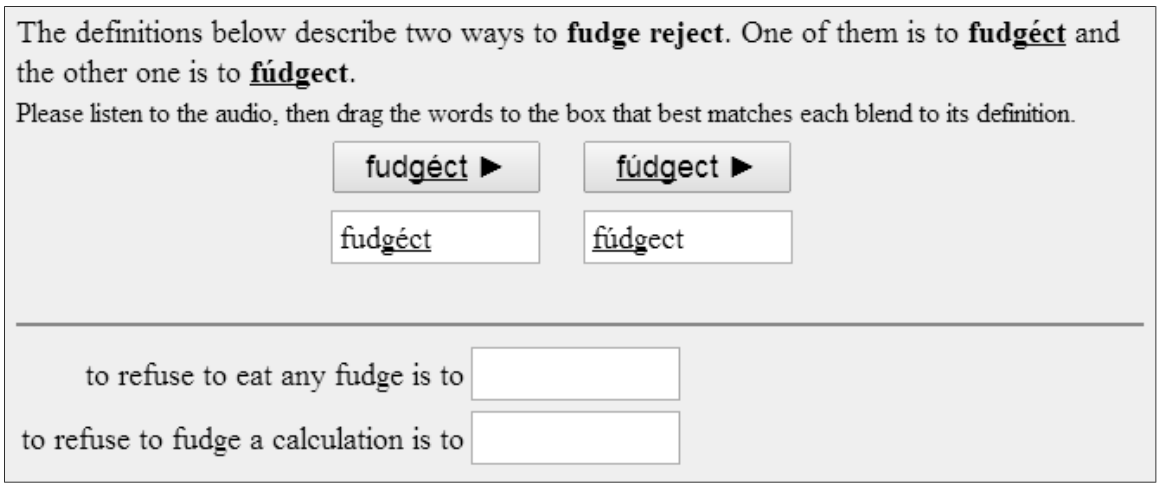
(24) Example: Stress blend (Exp 2, 4)

(a) Stress was indicated by accent marks and underlining of the stressed syllable

(b) Stress blends were presented with audio recordings

(c) Experiments included a stress pre-test page

- Task: Match *óbject* (N) and *objéct* (V) with their respective definitions
- Determined whether participants understood the stress notation



(25) Presentation order and structure

(a) 2×2 = 4 possible ways to present an item (blend pair + definition pair)

- Order of the blends *plotigate*|*plitigate* ~ *plitigate*|*plotigate*
- Order of the definitions N+V|V+V ~ V+V|N+V

→ These options were counterbalanced across participants

(b) Sequence of items was randomized for each participant

(26) Additional information collected

(a) Difficulty rating: *very easy* (1) to *very hard* (5)

(b) Post-survey questionnaire:

- Strategy that participants employed (if any)
- Were any pairs particularly difficult?
- Demographics: Native language, handedness, gender, level of education

3.3 Participant information

(27) Participants were recruited and paid using Amazon's Mechanical Turk (MT)

- See Sprouse (2011) on the use of MT for large-scale linguistics experiments

(a) MT is a web-based crowdsourcing application

(b) Provides access to large numbers of potential participants

(c) Participant criteria on Mechanical Turk for these experiments

- Restricted to US participants only
- MT task approval rate of 95% or better / At least 100 prior tasks "approved"

(28) 474 participants included in analysis

529 total; criteria for exclusion:

- Didn't answer all items (16)
- Didn't answer any demographics questions (32)
- English not the first language (8)
- Failed the stress pre-test (25)

(29) Participant demographics

(a) Gender: Similar numbers of men and women across the experiments

Experiment	Female	Male	Not reported
1 (NFaith | seg)	68	50	0
2 (NFaith | stress)	64	60	0
3 (HdFaith | seg)	71	52	0
4 (HdFaith | stress)	58	49	2

(b) Age: A wide range of ages, with the mean in the 30s

Experiment	Oldest	Youngest	Mean
1 (NFaith | seg)	64	20	36.85
2 (NFaith | stress)	76	19	35.1
3 (HdFaith | seg)	72	19	34.7
4 (HdFaith | stress)	69	19	36.8

4. Experiments: Results

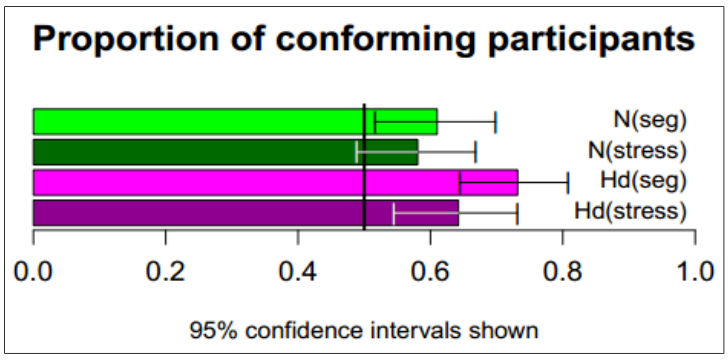
4.1 Analysis by participants

(30) Summary: Did **participants** gave a **majority of NFaith/HdFaith responses**?

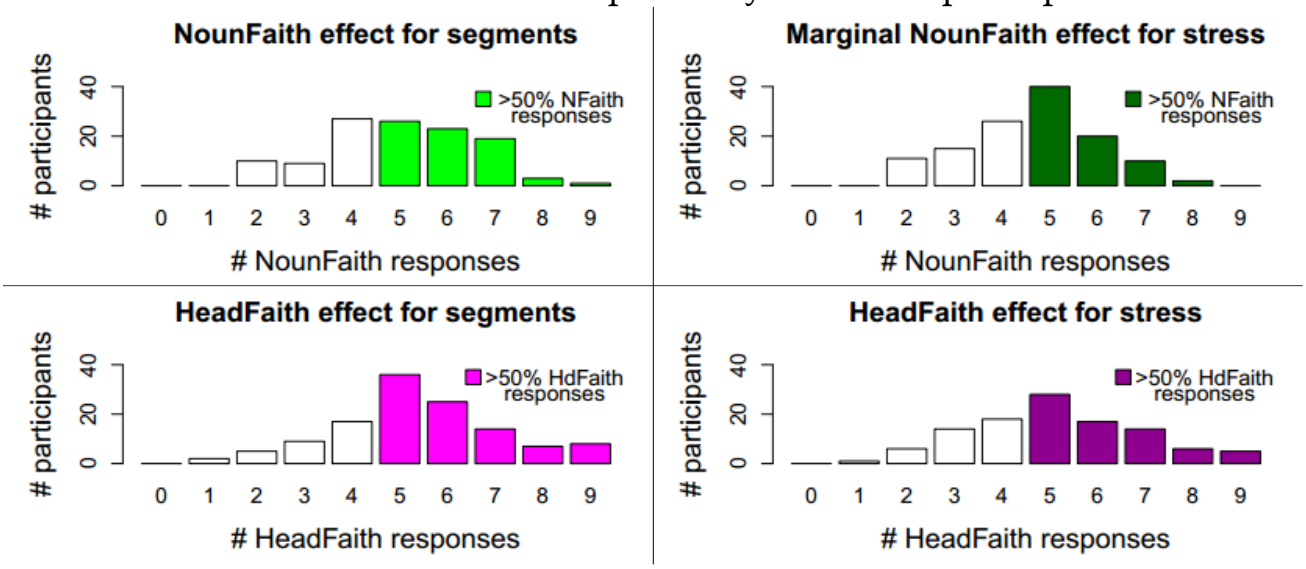
	segments	*stress*
NounFaith	yes	marginally
HeadFaith	yes	yes

- HeadFaith results replicate Shaw (2013)
  - Confirms sensitivity of methodology
- **NounFaith effect observed**
  - Weaker than HeadFaith
- Statistical analysis: Exact binomial test (see (33))

(31) Proportion of participants with a majority of NounFaith or HeadFaith responses



(32) Number of NounFaith/HeadFaith responses by individual participant



(33) Numerical results and statistical analysis: responses by participant

	# participants with *n* N(Hd)Faith responses									total # participants	# with **5+** N(Hd)Faith	significantly ≠ 50%?[1]	
	1	*2*	*3*	*4*	***5***	***6***	***7***	***8***	***9***				
N | seg	0	10	9	27	**26**	**23**	**19**	**3**	**1**	118	72 (61.0%)	$p = 0.02097$	*
N | stress	0	11	15	26	**40**	**20**	**10**	**2**	**0**	124	72 (58.1%)	$p = 0.08755$	.
Hd | seg	2	5	9	17	**36**	**25**	**14**	**7**	**8**	123	90 (73.2%)	$p < 0.00001$	***
Hd | stress	1	6	14	18	**28**	**17**	**14**	**6**	**5**	109	70 (64.2%)	$p = 0.00385$	**

[1]Exact binomial test, where a N(Hd)Faith-conforming response is scored as a success

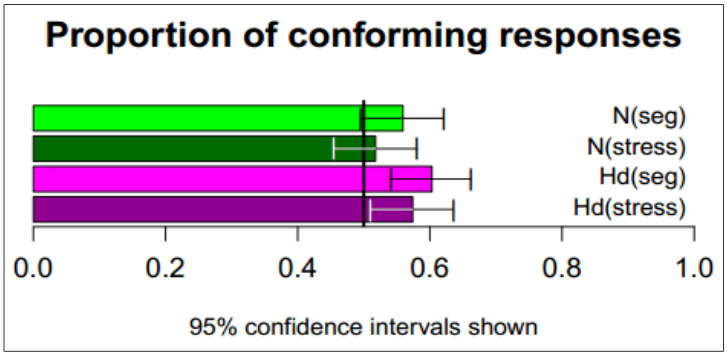
4.2 Analysis by responses

(34) Summary: How many of the **individual responses**, pooled across participants, conform to the NounFaith/HeadFaith predictions?

	segments	*stress*
NounFaith	marginally	not significant
HeadFaith	yes	yes

- HdFaith replicates Shaw (2013)
- **NFaith effect** is weaker
- Statistical analysis: Generalized linear mixed model (see (36))

(35) Proportion of NounFaith or HeadFaith responses across all participants



(36) Numerical results and statistical analysis[2]: individual responses across participants

	# conforming	# non-conforming	Estimate	Std. Error	*z* value	Pr(>|*z*|)	
N | seg	589 (55.5%)	473 (44.5%)	0.23821	0.13109	1.817	p=0.06920	.
N | stress	577 (51.7%)	539 (48.3%)	0.07118	0.12923	0.551	p=0.58176	
Hd | seg	663 (59.9%)	444 (40.1%)	0.41860	0.12997	3.221	p=0.00128	**
Hd | stress	560 (57.1%)	421 (42.9%)	0.29804	0.13201	2.258	p=0.02397	*

[2]Generalized linear mixed model fit by the Laplace approximation

This analysis models the probability of N(Hd)Faith-conforming responses in terms of:

- Experiment: N|seg, N|stress, Hd|seg, Hd|stress (modeled as a fixed factor)
- Items and participants are included as random intercepts

AIC	BIC	logLik	deviance
5782	5820	-2885	5770

Number of observations: 4266,
groups: participants, 474; items, 36

Random effects:

Groups	Name	Variance	Std.Dev.
participants	(Intercept)	0.12685	0.35616
items	(Intercept)	0.10840	0.32924

4.3 Discussion

(37) HeadFaith results replicate Shaw (2013); modified methodology is viable

(38) Apparent differences in effect size (but see §6 for more discussion)

- HeadFaith > NounFaith
- segmental preservation > stress preservation

(39) Is there a NounFaith effect? It looks like the answer is **yes**

(a) Both segmental, stress NounFaith effects at least marginal by participant

(b) NFaith stress effect is weak, but cannot be discounted yet—see §6

5. Noun faithfulness as an emergent effect for English speakers

(40) Exp 1–2 find NFaith effects in novel English blends

→ This section makes the case that these NFaith effects are **emergent**

(41) English speakers **have not learned a ranking** involving MaxSeg(N)

(a) Granted, N are longer than V (by syllable count) in English (Cassidy & Kelly 1991)

(b) However, *no active alternations* involving segment deletion distinguish N, V

(c) Furthermore, there is *no mandatory maximum size* for either N or V

→ Conclusion: **No evidence** is encountered during L1 acquisition of English for any crucial ranking involving the constraint MaxSeg(N)

(42) English speakers **have not learned a ranking** involving MaxStress(N)

(a) N and V have different default stress patterns (Chomsky & Halle 1968, Ross 1973), but both of these patterns involve defaults—not a matter of faithfulness

(b) If anything, N stress behavior is ***more*** predictable (***less*** indicative of faithfulness to underlying contrasts) than V stress behavior

Kelly & Bock (1988: 391), reporting stress data from Francis & Kučera (1982)

Disyllables used only as...	*N*	Initial stress	Final stress
Nouns	3002	94%	6%
Verbs	1021	31%	69%

- N show strong preference for initial stress
- V prefer final stress, but preference is not as strong

→ Conclusion: **No evidence** is encountered during L1 acquisition of English for any crucial ranking involving the constraint MaxStress(N)

(43) The emergent effects of NounFaith detected in our experiments are somewhat different from the **covert *ranking*** effects reviewed in (4)

(a) We are not claiming any particular *ranking* for MaxSeg(N) or MaxStress(N)
- Exception: NFaith >> VFaith, if there are VFaith constraints

(b) If the grammar is choosing between candidate **blend → definition assignments** as in (13)–(14), the only difference between the competing candidates is that one has **more NounFaith violations** than the other

(c) So: NounFaith constraints can have emergent effects even if **ranked very low**

6. Conclusions and implications

6.1 Segmental effects, stress effects, and phonological typology

(44) The NounFaith effects observed in phonological typology are very heavily skewed toward **prosodic**, rather than **segmental**, effects (Smith 2011)—*why not in blends?*
- The HeadFaith experiments (here and in Shaw 2013) likewise found a stronger effect for segmental preservation than for stress preservation in blends

(45) *Methodology?* Are these blend experiments **better at finding** segmental effects?

(a) Because the stress experiment involved a **harder task**?
- Participants listened to an audio file in the stress condition only
- Some English speakers find it hard to make *metalinguistic* stress decisions; to what extent would that interfere with our task?

(b) It might be informative to try an *audio-only* version of both tasks

(46) *Phonology?* Are segmental effects for positional faithfulness **actually phonologically more robust** than stress effects?

→ If so, this would be evidence that the prosodic bias in the typology of NounFaith effects is due to **channel bias**, not analytic bias (Moreton 2008)
- That is, both segmental and prosodic NounFaith patterns ***can* be learned**, but *something about acquisition/transmission* makes prosodic NounFaith patterns ***more likely* to be learned**

6.2 HeadFaith versus NounFaith

(47) The HeadFaith effects found here were stronger than the NounFaith effects, for both segmental and stress experiments—*why?*

(48) Difference between first/left word and second/right word?

(a) In our experiments, the head was on the right, but the noun was on the left
- Headed blends in English are overwhelmingly right-headed (Shaw 2013)
- The NounFaith experiments had to vary the nonhead rather than the head to keep output stress constraints and HeadFaith constraints consistent

(b) Arndt-Lappe & Plag (2013) found a tendency to preserve aspects of the second/right source word in English blends—in *non-headed* blends!

- Did this "right-side privilege" boost the HeadFaith, attentuate NounFaith?

→ Potentially informative to replicate these experiments in additional languages

6.3 The implications of finding emergent effects for NounFaith

(49) When emergent effects of covert constraints or constraint rankings are found:
- if they could not have been learned from L1 language experience
  → then they are evidence for universal aspects of the phonological grammar
    - *Universal* here may mean *innate*, but need not

(50) Our results provide evidence that **NounFaith constraints are universal**
- Complements (and replicates) results for HeadFaith (Shaw 2013; Shaw et al. 2014)
- Do *all* categories of positional faithfulness have emergent effects?
  → Can this line of research **distinguish** positional effects that are intrinsic to the phonological grammar from those that arise due to perceptual or phonetic factors?

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Appendix: Stimuli

(A1) Experiment 1 (NounFaith, Segmental)

Source words		**Blends**		**Definitions**
break	rectify	*breaktify*	N+V	to make up for a delayed paycheck with extra lunch time
		brectify	V+V	to fix something in a way that actually makes it worse
drain	renovate	*drainovate*	N+V	to renovate the plumbing in your house
		drenovate	V+V	to renovate your house until you bankrupt yourself
drag	regulate	*dragulate*	N+V	to make rules about what can be worn at a drag show
		dregulate	V+V	to make rules in order to drag a project out
brood	ridicule	*broodicule*	N+V	to ridicule someone's many children
		bridicule	V+V	to ridicule someone for sulking
creep	reprimand	*creepreprimand*	N+V	to scold someone because they are a creep
		creprimand	V+V	to scold someone when they creep up on you
plot	litigate	*plotigate*	N+V	to sue a plagiarist over the plot of a novel
		plitigate	V+V	to sue a conspirator when they plot against you
club	liberate	*cluberate*	N+V	to release someone from a society membership
		cliberate	V+V	to release a captive by bludgeoning their captors
spot	petrify	*spotrify*	N+V	to turn something to stone just in a few places
		spetrify	V+V	to turn something to stone just by noticing it
storm	terminate	*stormminate*	N+V	to artificially stop a violent storm
		sterminate	V+V	to end a meeting when you storm out of it

(A2) Experiment 2 (NounFaith, Stress)

Source Words		**Blends**		**Definitions**
watch	choose	*wátchoose*	N+V	to pick out a watch
		watchóose	V+V	to decide to watch
blubber	boast	*blúbboast*	N+V	to boast of how your crew brought back so much blubber
		blubbóast	V+V	to boast of how you made a younger child blubber
ship	prepare	*shípare*	N+V	to prepare a ship for something

		shipáre	V+V	to prepare to ship something
trip	repent	*trípent*	N+V	to repent after a trip you took
		tripént	V+V	to repent after you trip someone
spell	learn	*spéllearn*	N+V	to learn a magic spell
		spellearn	V+V	to learn to spell
fudge	reject	*fúdgect*	N+V	to refuse to eat any fudge
		fudgéct	V+V	to refuse to fudge a calculation
prune	enjoy	*prúnejoy*	N+V	to enjoy dried plums
		prunejóy	V+V	to enjoy trimming shrubbery
train	announce	*tráinounce*	N+V	to announce railway arrivals
		trainóunce	V+V	to announce that you will be working out
jam	permit	*jámit*	N+V	to permit sweet fruit preserves
		jámít	V+V	to permit musicians to improvise

(A3) Experiment 3 (HeadFaith, Segmental)

Source Words		**Blends**		**Definitions**
baboon	bandit	*baboondit*	COORD	a baboon who steals like a bandit
		babandit	R-HD	a baboon-stealing bandit
buccaneer	narrator	*buccaneerrator*	COORD	a pirate who tells stories
		buccanarrator	R-HD	someone who tells pirate stories
lampoon	punishment	*lampoonishment*	COORD	punishing someone by printing a lampoon
		lampunishment	R-HD	punishing someone for printing a lampoon
boutique	taxi	*boutixi*	COORD	a taxi with on-board boutique shopping
		boutaxi	R-HD	a taxi to the local boutiques
impala	polecat	*impalcat*	COORD	a hybrid of a polecat and an impala
		impolcat	R-HD	a polecat that hunts impalas
armadillo	dolphin	*armadilphin*	COORD	a hybrid of a dolphin and an armadillo
		armadolphin	R-HD	a dolphin with an armadillo's leathery skin
rhododendron	dandelion	*rhododendelion*	COORD	a cross between a dandelion and a rhododendron
		rhododandelion	R-HD	a dandelion that grows in rhododendron-like clusters
flamingo	mongoose	*flamingoose*	COORD	a hybrid of a mongoose and a flamingo
		flamongoose	R-HD	a mongoose that preys on flamingos
piranha	rhino	*piranho*	COORD	a hybrid of a rhino and a piranha
		pirhino	R-HD	a rhino that is fierce like a piranha

(A4) Experiment 4 (HeadFaith, Stress)

Source Words		**Blends**		**Definitions**
zebra	giraffe	*zébraffe*	COORD	a cross between a giraffe and a zebra
		zebráffe	R-HD	a giraffe with zebra stripes
robin	baboon	*róboon*	COORD	a cross between a baboon and a robin
		robóon	R-HD	a baboon with a robin-red chest
turkey	raccoon	*túrcoon*	COORD	a cross between a turkey and a raccoon
		turcóon	R-HD	a raccoon that steals turkey eggs
flounder	sardine	*flóundine*	COORD	a cross between a sardine and a flounder
		flounďine	R-HD	a type of sardine eaten by flounder
bachelor	valet	*báchelet*	COORD	a valet who is also a bachelor
		bachelét	R-HD	a valet who works for a bachelor
bistro	garage	*bístrage*	COORD	a building containing a garage and a bistro
		bistráge	R-HD	the delivery garage of a bistro
pygmy	premier	*pýgmier*	COORD	a leader who is also a pygmy
		pygmíer	R-HD	a leader of the pygmies

raisin	dessert	*ráissert*	COORD	a type of raisin eaten for dessert
		raissért	R-HD	a raisin-filled dessert
lizard	gazelle	*lízelle*	COORD	a hybrid of a gazelle and a lizard
		lizélle	R-HD	a gazelle that is scaly like a lizard

References

Albright, Adam. 2008. How many grammars am I holding up? *WCCFL* 26: 1-20.

Arndt-Lappe, Sabine & Ingo Plag. 2013. The role of prosodic structure in the formation of English blends. *English Language and Linguistics* 17: 537-563.

Anttila, Arto. 2002. Morphologically conditioned phonological alternations. *NLLT* 20: 1-42.

Barnes, Jonathan. 2006. *Strength and weakness at the interface: Positional neutralization in phonetics and phonology*. Berlin: Mouton.

Becker, Michael. 2013. Experigen [Computer software]. Accessed March 2013 at [*https://github.com/tlozoot/experigen*].

Beckman, Jill N. 1999. *Positional Faithfulness.* New York: Garland.

Berent, Iris, Donca Steriade, Tracy Lennertz, and Vered Vaknin 2007. What we know about what we have never heard: evidence from perceptual illusions. *Cognition* 104:591-630.

Broselow, Ellen, Su-I Chen, and Chilin Wang. 1998. The emergence of the unmarked in second language phonology. *Studies in Second Language Acquisition* 20: 261–80.

Cable, Seth. 2005. Phonological noun-verb dissimilarities in Optimal Paradigms. Ms., MIT. [Revised version of paper presented at the Workshop on (Non)-identity Within a Paradigm.]

Cassidy, Kimberly Wright, and Michael H. Kelly. 1991. Phonological information for grammatical category assignments. *Journal of Memory and Language* 30: 348-369.

Chomsky, Noam, and Morris Halle. 1968. *The sound pattern of English*. New York: Harper and Row.

Davidson, Lisa. 2001. Hidden rankings in the final state of the English grammar. In Graham Horwood and Se-Kyung Kim (eds.), *RuLing Papers II*, 21-48. New Brunswick: Rutgers University.

Davidson, Lisa. 2010. Phonetic bases of similarities in cross-language production: Evidence from English and Catalan. *Journal of Phonetics* 38: 272-288.

Francis, W. Nelson, and Henry Kučera. 1982. *Frequency analysis of English usage: Lexicon and grammar.* Boston: Houghton Mifflin.

Ito, Junko, and Armin Mester. 1999. The structure of the phonological lexicon. In Natsuko Tsujimura (ed.), *The Handbook of Japanese Linguistics*, 62-100. Oxford: Blackwell.

Ito, Junko, and Armin Mester. 2001. Covert generalizations in Optimality Theory: the role of stratal faithfulness constraints. *Studies in Phonetics, Phonology and Morphology* 7: 3-33.

Jaber, Aziz. 2011. High vowel syncope in Jordanian Arabic: A positional faithfulness treatment. Ms., UNC Chapel Hill.

Jacobs, Haike, and Carlos Gussenhoven. 2000. Loan phonology: perception, salience, the lexicon and OT. In J. Dekkers et al. (eds.), *Optimality Theory: Phonology, Syntax, and Acquisition*, 193-210. Oxford: OUP.

Jesney, Karen. To appear. A learning-based account of L1 vs. L2 cluster repair differences. In Utako Minai, et al. (eds.), *Selected Proceedings of the 5th Conference on Generative Approaches to Language Acquisition – North America* (GALANA 2012). Somerville, MA: Cascadilla Proceedings Project.

Kelly, Michael H., and J. Kathryn Bock. 1988. Stress in time. *Journal of Experimental Psychology: Human Perception and Performance* 14: 389-403.

McCarthy, John, and Alan Prince. 1994. The emergence of the unmarked: Optimality in prosodic morphology. *NELS* 24, vol.2, 333-379.

Moreton, Elliott. 2008. Analytic bias and phonological typology. *Phonology* 25:83-127.

Moreton, Elliott, Gary Feng, and Jennifer L. Smith. 2008. Syllabification, sonority, and perception: new data from a language game. *CLS* 41 (vol. 1): 341-355.

Pater, Joe. 2010. Morpheme-specific phonology: Constraint indexation and inconsistency resolution. In Steve Parker, (ed.) *Phonological argumentation: Essays on evidence and motivation*, 123-154. London: Equinox.

Ross, J.R. 1973. Leftward ho! In Steven R. Anderson & Paul Kiparsky (eds.), *A Festschrift for Morris Halle*, 166-173. New York: Holt, Rinehart, & Winston.

Shaw, Katherine E. 2013. Head faithfulness in lexical blends: A positional approach to blend formation. MA thesis, UNC.

Shaw, Katherine E., Andrew M. White, Elliott Moreton, and Fabian Monrose. 2014. Emergent faithfulness to morphological and semantic heads in lexical blends. In John Kingston, Claire Moore-Cantwell, Joe Pater, and Robert Staubs (eds.), *Proceedings of the 2013 Meeting on Phonology*. Washington, DC: LSA.

Smith, Jennifer L. 2011. Category-specific effects. In Marc van Oostendorp, Colin Ewen, Beth Hume, & Keren Rice (eds.), *The Blackwell Companion to Phonology*, 2439-2463. Malden, MA: Wiley-Blackwell.

Sprouse, Jon. 2011. A validation of Amazon Mechanical Turk for the collection of acceptability judgments in linguistic theory. *Behavior Research Methods* 43: 155-167.

Zhang, Hang. 2013. *The acquisition of Mandarin Chinese tones by English, Japanese, and Korean speakers.* PhD dissertation, UNC.