Structural Priming and Non-Native Language Processing

Douglas J. Getty, Scott H. Fraundorf

Contemporary theories generally hold that comprehension is fast and accurate because it draws on experience with the linguistic environment [e.g., 1, 2]. But, variability in spoken language can pose a challenge by rendering prior experience unhelpful or even misleading [3].To study how comprehenders overcome this challenge, we examined differences in listening to native (Nat) vs. non-native (NN) speakers. NN speakers typically do not achieve Nat-like proficiency [4], resulting in accented speech and higher rates of syntactic errors. Past findings suggest that comprehension of NN speech may be underspecified relative to Nat speech [5,6,7]. We contrast two accounts of why this may occur: (a) An expectation account whereby listeners expect lower linguistic competence in NN speakers, and thus adaptively rely less on the literal speech input and more on top-down methods of comprehension [5].This account predicts that reduced proficiency should *always* lead to less reliance on bottom-up input. (b) A "good enough" account assumes that listeners optimize comprehension resources to the task goal [8]. This account predicts that listeners *may* use heuristic-based processing to comprehend NN speech but *can* process it deeply if prompted (e.g. if a low proficiency NN speaker requires more resources).

Method. We adapted the **classic syntactic-priming paradigm** [9] to the online Qualtrics platform. In each of 48 critical trials, participants first heard a dative prime sentence in either the prepositional-object structure (PO, *1a* in Table 1) or double-object structure (DO, *1b*). Immediately after, they typed a description of an unrelated dative-eliciting image. All prime-target pairs were pseudo-randomly embedded within a list of 144 unrelated filler sentences and images. Picture descriptions were coded as either a PO, DO, or OTHER and analyzed using linear mixed-effects regression models separately for each block (see Table 2). Comprehension was assessed on 48 filler sentences to ensure attention remained on-task.

Results Exp 1 (N=128). Speaker was manipulated within-subjects in a blocked design, such that half participants heard 24 primes spoken by a NN speaker (L1 Mandarin) in Block 1, followed by 24 primes spoken by a Nat speaker (Block 2), or the reverse counterbalanced order. In each block, we **replicated the classic syntactic-priming effect** (main effect of Prime, increased probability of producing POs after PO primes). Critically, in Block 1, we also observed a negative interaction between Speaker and Prime, driven by a **reduced priming effect in the NN speaker condition** (Table 2; Figure 1a). The reduction in priming does not appear to be driven by reduced attention to the task (*M* comprehension accuracy = 99% for both Nat and NN conditions), but rather a mode of processing that relies less on structural information, consistent with both the "expectation" and "good enough" accounts. Interestingly, this reduced priming **carried over into Block 2** such that participants who were primed less by the NN speaker in Block 1 were also primed less by Nat speaker in Block 2, and vice versa (Figure 1b).

Results Exp 2 (N=114). Exp. 2 used the same design, except both talkers were NN (L1 Mandarin), and one was manipulated to be less proficient by introducing ungrammaticalities on 30% of the filler sentences (e.g. Table 1, *2a-2b*). In Block 1, there was a main effect of Prime and a positive interaction, suggesting **the less proficient speaker elicited *more* priming** (Table 2; Figure 2a). By Block 2, the main effect remained, but there was no difference in priming between the less proficient and more proficient conditions (Table2; Figure 2b).

Discussion. We found that **NN speaker status and NN speaker proficiency influence priming**. In Exp. 1, decreased priming for the NN speaker in Block 1 carried over into subsequent processing of the Nat speaker in Block 2, while those exposed to the Nat speaker first showed consistent priming throughout. While both accounts predict the reduced priming effect, the carryover effect is explained by the "good enough" principle that processing adapts to the task. In Exp. 2, proficiency does influence priming; however, given the direction of the interaction, the results are again more consistent with the "good enough" account that allows for increased resources to processing if the task demands. We suggest that listeners' comprehension of NN speech reflects **contextually optimized processing strategies rather than an intrinsic reliance on top-down comprehension** when processing NN speech**.**

References
[1] Levy (2008). Cognition. [2] MacDonald et al. (1994). [3] Liberman et al., (1967). [4] Birdsong & Molis (2001). JML. [5] Lev-Ari (2015). Front. Psych. [6] Hanulíková et al. (2012). JCN. [7] Gibson et al. (2017). Psych Sci. [8] Karimi & Ferreira, (2016). QJEP. [9] Bock (1986). Cog Psych.

Table 1. Example sentences. Primes like 1a-1b were used in both experiments, while ungrammatical sentences like 2a-2b were only used in Experiment 2.

Prime Sentences (Exp 1 and Exp2)	
(1a) Dative {PO}:	The man gave the toy to his daughter.
(1b) Dative {DO}:	The man gave his daughter the toy.
Ungrammatical Fillers (Exp 2)	
(2a)	The janitor **is clean a floors** daily.
(2b)	The union leader **is assist a workers** in **organize** the strike.

Table 2. Fixed-effects test of priming in each model. A near-maximal random-effects structure was used in each model. Estimates reflect the probability (in logits) of producing a PO in each condition (descriptions coded as OTHER were dropped for analysis).

	Experiment 1					***Experiment 2***				
		Beta	SE	z	*p*		Beta	SE	z	*p*
Block 1	(Intercept)	0.24	0.22	1.11	.27	(Intercept)	-0.19	0.23	-0.83	.400
	Prime	0.47	0.11	4.25	<.001	Prime	0.63	0.12	5.14	<.001
	Speaker	0.25	0.32	0.80	.42	SpeakProf	-0.10	0.27	-0.38	.71
	Prime:Speaker	-0.67	0.22	-3.01	<.01	Prime:SpeakProf	0.78	0.24	3.23	<.01
Block 2	(Intercept)	0.04	0.19	0.23	.82	(Intercept)	-0.69	0.21	-3.25	<.01
	Prime	0.57	0.12	4.82	<.001	Prime	0.66	0.12	5.43	<.001
	Speaker	-0.41	0.31	-1.32	.19	SpeakProf	-0.21	0.36	-0.57	0.57
	Prime:Speaker	0.72	0.24	3.06	<.01	Prime:SpeakProf	-0.35	0.23	-1.53	0.13

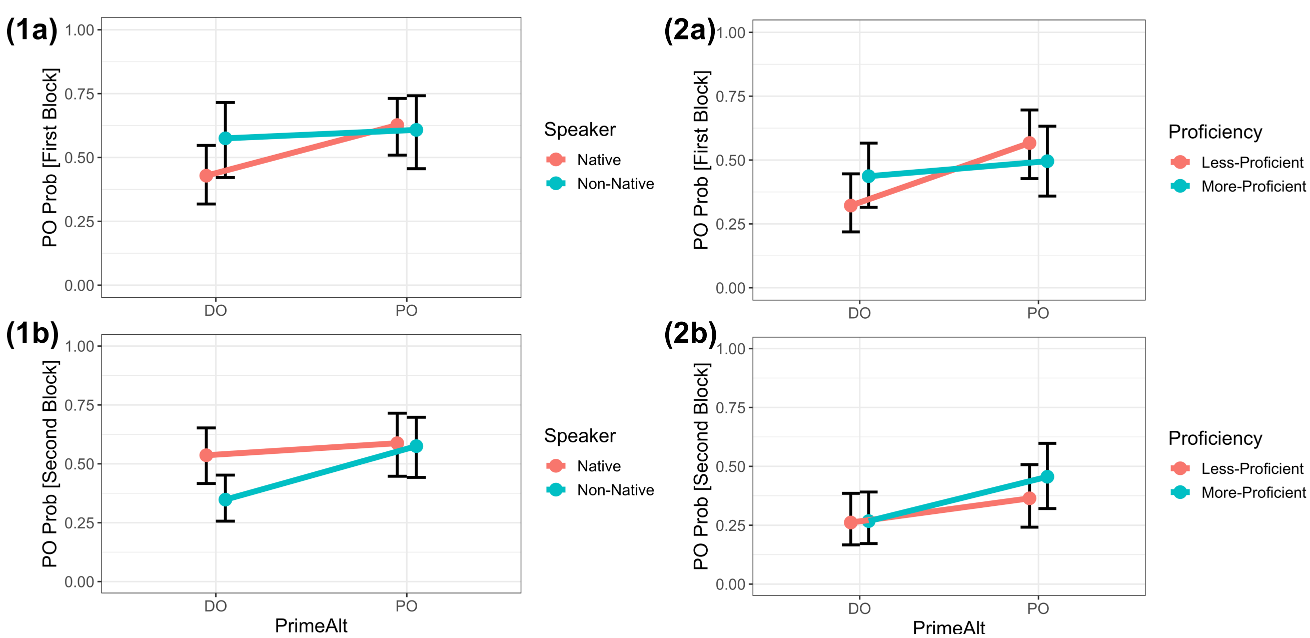

Figure 1a-2b. Points represent model-estimated marginal means, transformed from logits to probability. Errors bars represent 95% confidence intervals.