Tabak & al. 2010.
Producing inflected verbs: a picture naming study

(1) Some previous studies

- Baayen & al. 2008b (Dutch nouns): the more inflectional entropy, the slower the picture-naming
  - if sg. & pl. have similar frequencies, entropy is large → slow RT
  - if sg. & pl. have disparate frequencies, entropy is small → faster RT
- Tabak & al. 2010 (English and Dutch verbs): the more inflectional entropy, the slower people were to produce past given present or present give past—but only significant for irregulars

(2) Exp. 1: plain picture naming, present-tense verbs, Dutch

- Photographs with same actor, same background, restricted set of props
- Verbs differed in regular (half) vs. irregular; lemma frequency; present-tense frequency; inflectional entropy; length (in phonemes); picture complexity (in size of compressed JPG file!)
  - recall: high entropy means all the inflected forms are pretty similar in frequency; low entropy means there's a strong skew towards certain inflected forms
  - photographer and actor also reported that the regulars were harder to depict
  - also added "picture entropy": low if everyone answered the same word, high if they were all over the place
  - and whether the stem has a final obstruent that alternates in voicing
- Subjects supposed to respond with *Today she's* _____*ing*.
- Computer records response time (sound-activated)
- Result of most interest: lemma frequency has a U-shaped effect
  - faster the more frequent, except not for the most frequent (slightly slower than medium-frequent)

	Estimate	lower HPD95	upper HPD95	p (MCMC)
Intercept	6.8938	6.5028	7.2891	0.0001
Trial	0.0004	0.0002	0.0006	0.0004
Previous RT	0.0384	0.0087	0.0744	0.0152
Picture Entropy	0.1603	0.1249	0.2009	0.0001
Picture Complexity	0.0011	0.0001	0.0020	0.0190
Correct=incorrect	0.3047	0.0958	0.4457	0.0030
Sex: contrast female	-0.0292	-0.1239	0.0666	0.5262
Inflectional Entropy	0.0526	-0.0178	0.0868	0.1992
Lemma Frequency (linear)	-0.0959	-0.1683	-0.0271	0.0118
Lemma Frequency (quadratic)	0.0057	0.0015	0.0103	0.0132
Correct=incorrect : Sex=female	-0.0573	-0.1048	-0.0045	0.0296
Picture Entropy : Sex=female	0.0429	0.0076	0.0732	0.0138
Inflectional Entropy : Correct=incorrect	-0.0929	-0.1534	0.0058	0.0622

Table 1: Coefficients in the mixed-effects model fit to the picture naming latencies of Experiment 1 (unprepared present-tense naming). Upper/lower HPD95: 95 percent credible intervals based on 10,000 Markov chain Monte Carlo samples from the posterior distribution of the parameters.

(p. 33 of ms.)

(3) Exp. 2: same thing, but respond with *Yesterday, she _____ed*.

- Again, U-shaped effect of lemma frequency.
- Also, if past tense itself is more frequent, faster RT.
- The more rhyming irregulars exist, the faster the RT for irregulars

	Estimate	lower HPD95	upper HPD95	p (MCMC)
Intercept	7.3860	7.1978	7.6560	0.0001
Trial	0.0007	0.0005	0.0009	0.0001
Sex=female	-0.0731	-0.1897	0.0472	0.2222
RhymeCount	-0.0408	-0.0610	-0.0178	0.0004
Past Tense Frequency	-0.0311	-0.0488	-0.0148	0.0010
Picture Entropy	0.1576	0.1209	0.1907	0.0001
Lemma Frequency (linear)	-0.0758	-0.1398	-0.0336	0.0022
Lemma Frequency (quadratic)	0.0049	0.0022	0.0090	0.0018
Picture Entropy : Sex=female	0.0466	0.0146	0.0771	0.0024

Table 2: Coefficients in the mixed-effects model fit to the picture naming latencies of Experiment 2 (unprepared past-tense naming)

(p. 34 of ms.)

(4) Exp. 3: like Exp. 1, but "prepared"

- After exp. 1, participants silently read through picture book with the stimuli they'd jut seen, with the target verbs printed below each photo.
- Task repeated, but now participants were asked to try to use those words (*Today she's ___ing*).
- Higher lemma frequency made RT slower !?
- Words with voicing alternations slower
- Verbs that rhyme (in present) with more other irregulars were faster

	Estimate	lower HPD95	upper HPD95	p (MCMC)
Intercept	6.8398	6.7356	6.9504	0.0001
Trial	0.0003	0.0001	0.0005	0.0010
Picture Entropy	0.1784	0.1428	0.2121	0.0001
Alternating=TRUE	0.0766	0.0381	0.1172	0.0002
Picture Complexity	0.0011	0.0004	0.0018	0.0038
Lemma Frequency (centered)	0.0306	0.0174	0.0442	0.0001
RhymeCount	-0.0059	-0.0104	-0.0016	0.0084
Present Tense Frequency	-0.0170	-0.0525	0.0164	0.3036
Sex=female	-0.0605	-0.1735	0.0464	0.2566
Present Tense Frequency : Sex=female	0.0518	0.0218	0.0820	0.0014

Table 3: Coefficients in the mixed-effects model fit to the picture naming latencies of Experiment 3 (prepared present-tense naming)

(p. 35 of ms.)

(5) Exp. 4: like Exp. 2, but "prepared"

- U-shaped lemma frequency effect
- More-frequent past-tense form → faster response
- Voicing alternation again slowed responses

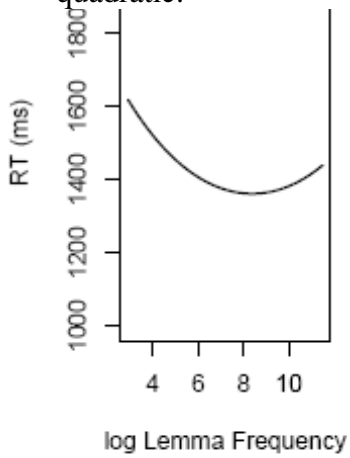
	Estimate	lower HPD95	upper HPD95	p (MCMC)
Intercept	7.1075	6.6139	7.5584	0.0001
Trial	0.0005	0.0003	0.0007	0.0001
Regularity=regular	-0.5060	-1.0148	-0.0129	0.0388
Sex=female	-0.2079	-0.3627	-0.0606	0.0062
Picture Entropy	0.1597	0.1250	0.1958	0.0001
Lemma Frequency (linear)	-0.1163	-0.1865	-0.0501	0.0022
Lemma Frequency (quadratic)	0.0092	0.0047	0.0137	0.0002
Alternating=TRUE	0.6652	0.1433	1.2079	0.0124
Previous RT	0.0519	-0.0021	0.1081	0.0630
Inflectional Entropy	-0.0768	-0.1502	-0.0067	0.0290
Past Tense Frequency	-0.0238	-0.0469	0.0004	0.0520
Previous RT : Alternating=TRUE	-0.0809	-0.1614	-0.0124	0.0278
Inflectional Entropy: Sex=female	0.0636	0.0082	0.1252	0.0318
Previous RT: Regularity=regular	0.0770	0.0093	0.1479	0.0214

Table 4: Coefficients in the mixed-effects model fit to the picture naming latencies of Experiment 4 (prepared past-tense naming)

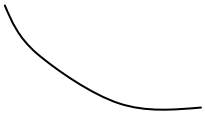
(p. 36 of ms.)

(6) Summary and highlights (and a little what-does-it-mean-for-us)

- Persistent U-shaped lemma frequency effect
  - Tabak & al. 2010b found the same thing.
  - "we hypothesize that this U-shaped effect arises as a consequence of subjects optimizing their performance for verbs with the most likely, 'central', lemma frequencies." (p. 16 of ms.)
  - I wonder what this optimization would consist of—how might you adjust your system so that medium-frequency words are handled the fastest?
  - But, as Bien & al. 2005 discuss, U-shaped effects can just be artefacts of fitting a quadratic:



What if it really just tails off, like this:



(Exp. 1, p. 28 of ms.)

- Voicing alternations mattered only in "prepared" tasks
  - "This suggests that words with more variable morphophonology are at a disadvantage in speech production. This disadvantage is strongest when subjects are naming the pictures quickly, as indexed by *Previous RT*, and decreases where they go through the experiment more slowly. Apparently, selecting the correct phonological form slows processing only when the choice between alternatives has to be made rapidly." (pp. 14-15 of ms.)
  - It didn't seem to matter whether verb was regular or irregular, even though you might expect storage of irregulars to mean there's no need to apply a phonological rule
- Regulars and irregulars different semantically
  - Bigger JPF files for regulars
  - More variety in responses when target was regular
  - Presumably chicken, not egg: basic, frequent words tend to be both irregular and easy to depict.
  - Supports concern that semantics can be important confound in comparing regulars and irregulars.
- Inflectional entropy effect probably not worth puzzling over too much, since no consistent result.

Predictor	Exp. 1 present unprepared	Exp. 2 past unprepared	Exp. 3 present prepared	Exp. 4 past prepared
Trial	+	+	+	+
Picture Entropy	+ *Sex*	+ *Sex*	+	+
Picture Complexity	+ *Sex*		+	
Alternating			+	+− *Previous RT*
Previous RT	+			+ *Regularity, Alternating*
Rhyme Count		−	−	
Correctness	+− *Sex*			
Lemma Frequency	U	U	+	U
Form Frequency		−	+ *Sex*	−
Inflectional Entropy	− *Correct*			+− *Sex*
Regularity				− *Previous RT*

Table 5: Overview of predictors by experiment. +: positive slope, −: negative slope, U: U-shaped effect; interactions with *Sex*, *Regularity*, and *Correctness* are indicated where present. (p. 37 of ms.)