

Harvard ISOKL-2005 Abstract Submission

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Title: A Bayesian Account of Loanword Adaptations  
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By itself, the Free Ride principle is not enough to account for the adaptation of loanwords, as it offers no way to predict which Free Ride the learner will take.

We offer instead an analysis-by-synthesis account based on Bayesian statistical principles, with a minimum of assumptions. Bayes's rule is given in (6a), its application to the present problem using the McCarthy 2004 quote as a background is given in (6b).

$$(6) \quad \begin{array}{l} \text{a. } p(A|B) = p(B|A) * p(A)/p(B) \\ \text{b. } p(A/ | [B]) = p([B] | /A/) * p(/A/) / p([B]) \end{array}$$

(6b) says that the probability of choosing /A/ given that the learner hears [B] is proportional to the probability that the learner would pronounce [B] from /A/ (this is the analysis-by-synthesis part) and the probability of /A/, either derived from existing statistics over the lexicon, or in the absence of a lexicon (i.e. in the earliest word-learning), from general principles of markedness of UR's (contra Richness of the Base). Given a set of alternative hypotheses /A<sub>1</sub>/, /A<sub>2</sub>/, ..., /A<sub>n</sub>/, the learner would calculate odds ratios based on the application of (6b) to each hypothesis. The hypothesis space of interest here is the set of possible UR's given final [t]: /t th t' s s' c ch c' h/. For these cases p([t]/A<sub>i</sub>/) is 1 (they all would be pronounced as [t] in final position), and so the expression p([t] | /A<sub>i</sub>/) will cancel out in each case. Likewise, since p([t]) is constant across the hypothesis space, it will also cancel out, so the answer to the equation is p(/A<sub>i</sub>/)/p(/A<sub>j</sub>/), as shown in (7).

$$(7) \quad \begin{aligned} p(/A_i/|[t]) / p(/A_j/|[t]) &= [p([t] | /A_i/) * p(/A_i/) / p([t])] / [p([t] | /A_j/) * p(/A_j/) / p([t])] \\ &= p(/A_i/) / p(/A_j/) \end{aligned}$$

Bayesian leaning thus says the odds in choosing an underlying form should favor the most probable form given the existing lexicon. In this case, Korean morphemes with final /s/ are much more numerous, therefore p(/...s#/) >> p(/...t#/), and therefore final /s/ should be favored over final /t/. However, the odds ratio idea suggests frequency matching as a general strategy, similar to animal foraging behavior and many other animal learning problems (Gallistel 1990: 351-2). Thus we expect variation in loanword adaptation, which in the limiting case (i.e. without other interfering factors) should match the existing lexical statistics for the learner. Obviously, to test this prediction, we need to carefully examine statistics about the Korean lexicon. Given the Bayesian account, principles like Lexicon Optimization and Free Rides are completely superfluous.

## References

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