Linguistics 201 B. Hayes
Phonological Theory II Winter 2009

Homework #3: Tools for studying variation

Due Mon. 2/2/09 in class

1. Analyzing variation/diagnosing your analysis

Download the spreadsheet **GLAExercise.xls** from the course website, http://www.linguistics.ucla.edu/people/hayes/201/

The spreadsheet looks like this. To avoid font issues, the file uses ad hoc symbols, translated below.

			*G^{j}	AGREE(back)	*NC	IDENT(voice)
			*G^{j}	AGREE(back)	*NC	IDENT(voice)
/aNki/ = [aŋki]	aNki = [aŋki]	40		1	1	
	aNkji = [aŋk^{j}i]	10	1		1	
	aNgi = [aŋgi]	40		1		1
	aNgji = [aŋg^{j}i]	10	1			1

The meaning of the third column is that in the language in question, the four outputs for the given input surface 40, 10, 40, and 10 percent of the time.

Assume constraints of the following type:

*G^{j}	violated by all palatalized (i.e. fronted) velars
AGREE(BACK)	violated by all plain velars preceding a front vowel
*NC̥	violated by all voiceless consonants following a nasal
IDENT(VOICE)	violated when /k/ changes to [g]

(1) Before you run OTSoft, think about how to get these probabilities from a stochastic grammar. You should figure out the two pairwise ranking probabilities between constraints that are needed. Make a little Hasse diagram (arrows labeled with probabilities) to illustrate them.

2) Using OTSoft 2.3, run the Gradual Learning Algorithm on the file, and verify that it can roughly match the percentages in the learning data. Provide a printout. Explain in qualitative terms how the ranking values accomplish this. Be specific: *how does the learned grammar derive 40/10/40/10*?

Here are suggested parameter settings for running the GLA on OTSoft. All are set from the GLA screen, which you get to see after clicking on the **Rank** button:

a) From **Options**, select **Include pairwise ranking probabilities**. This gives you the probability that any one constraint will outrank any other, when the finished grammar is run on any given occasion. Inspecting this output is highly recommended.

b) Set **Number of times to go through forms** at 100000, **Initial plasticity** at 2, **Final plasticity** at .0001, and **Number of times to test grammar** at 10000.

3) Visit the spreadsheet at http://www.linguistics.ucla.edu/people/hayes/gla/. Determine why the "ranking values" obtained by the Gradual Learning Algorithm match up (more or less) with those you obtained by reasoning in question #1. (You can find a setting of OTSoft that does this automatically, but I'd like you to consult the spreadsheet so this part is not like magic.)

4) Now use the maxent algorithm on the file, and report the weights you find. Assuming that the algorithm finds the lowest weights that will work, explain the weights it found.

5) Lastly, change the percentages in the third column of the spreadsheet from 40, 10, 40, 10 (as above) to 40, 10, 10, 40. Run both the GLA and maxent. In each case, report and explain what happened.

2. Maxent vs. stochastic OT

Here are parallel grammars:

Stochastic OT		*Maxent*	
Constraint	Ranking value	Constraint	Weight
C1	100	C1	1
C2	100	C2	1

Consider two candidates Cand1 and Cand2. Cand1 violates only C1, Cand2 violates only C2. Explain why the two grammars don't necessarily make the same predictions.

3. Optional questions

If you know a lot of math you should consider these questions obligatory.

a. Specify a procedure by which an Anttila-grammar can be approximated by a stochastic OT grammar. Specify the divergences between your approximation and the corresponding Anttila-grammar.

b. Specify a procedure by which a classical (nonstochastic) OT grammar can be approximated by a maxent grammar. Specify the divergences found in your approximation.

c. Explain why an Antilla-grammar cannot be approximated in maxent.