

Phonological Constraints and Contextual Slips of the Tongue: Some questions of chickens and eggs¹

Anne-Michelle Tessier

Department of Linguistics, University of Alberta

Introduction

This talk starts with some connections between two kinds of data, which are by now well-noted in the literature (see esp. Dressler 1979, Hansson 2001ab, Rose and Walker 2004, Walker 2007):

- Long-Distance Consonant Agreement (LDCH)

Navajo sibilant harmony (examples from McDonough 2003)

- 1) a) /O-ʃ-dzɪs/ → [yɪsdzɪs] 'I drag it'
b) /sis-l-dʒool/ → [ʃɪfdʒool] 'I lie huddled'

- 'Contextual' Slips of the Tongue: (anticipations and) perseverations²

- 2) a) /'sɛ.ʃʌn/ → [ʃɛ.ʃʌn] 'session'
b) /,pəʒən fə 'pəʃ/ → [,pəʒən fə 'pəʃ] 'Persian for 'purse'
c) we could just /tas/ → /tʃas/ out these /tʃɛks/
'toss out these checks'
d) They don't /meɪk peɪmənts/ → [peɪk peɪmənts] on it
'make payments'
e) That /saʊndz fʌni/ → [faʊndz fʌni] 'sounds funny'
f) /deɪ/ → [dʒeɪ] of the [dʒækɪ] 'Day of the Jackal'
g) 'televitie, uh... televisie' 'television' (Dutch)

¹I would like to especially thank Marnie Krauss, whose joint work with me led to this current project. I also thank Dorie Erickson, Robert Kirchner, Rachel Walker and Gunnar Hansson for discussion and input, in various very different stages of this work – though none of them are responsible for anything I say here, errors and all.

²Errors (2a,b) from Krauss (2008); (2c,f) from Stemberger (1991), (2d,e) from Stemberger 1989, (2g) from Wijnen (1992).

Traditional view: (1) is competence and (2) is performance.
Still, they have a lot (though not everything) in common.

Depending on the nature of the grammar and the way we think its knowledge is used online, a unified account of both might be possible and/or even right.

First half of the talk:

- proposal for how grammatical mechanisms that drive (1) could be fruitfully used to drive (2) (also: Goldrick and Daland in press, Krauss 2008)

Proposal built from:

- normal LDCH constraints
- a stochastic constraint-based grammar...
- ... with an inherent and asymmetric IO-Faith-demoting bias

In this view, we have slips of the tongue because we have LDCH constraints (and because of noise in the grammar)

However! The connection between (1) and (2) has been used in a few different places in the literature to argue precisely the reverse:

Alternative account (most explicitly in Hansson 2001ab):

- over time, frequent speech errors are somehow 'phonologized' into LDCH constraints

In this view, we have LDCH because we have contextual slips of the tongue, re-interpreted as phonology

Second half of the talk:

- an attempt to tease apart these two causal accounts of this correlation.

Preview of Conclusions:

- some serious, though perhaps not insurmountable, obstacles to the view that LDCH constraints are 'phonologized' speech errors
- the need for more cross-linguistic data: to expand the typology both of slips of the tongue studies and also *child-specific* harmonies.

11) Ranking that induces LDCH

/ʃ-iz-taʔ/	CORR-[s] ⇔[]	IDENT-CC [DIST]	IDENT-IO [DIST]
fiztaʔ	*!		
ʃkizktaʔ		*!	
ʃkizktaʔ			*

1.3 The role of similarity

LDCH does not target random sets of segments to bring into correspondence
 Instead: *more similar* sounds are more likely to participate in LDCH

12) Example: LDCH nasal harmony (see refs. in Hansson 2001a)

- Sawai: nasality affects oral sonorants [r]
- Hausa: nasality affects oral sonorants [l]
- LuGanda: nasality affects homorganic voiced/voiceless stops
- Kikongo, Yaka: nasality affects voiced stops and oral sonorants [l]
- Tiene: nasality affects all stops, sonorants

To encode this similarity connection:

fixed ranking of CORR-CC constraints, wrt each single featural dimension

13) Fixed rankings of Corr-CC targeting nasals

- CORRCC [n] ⇔ [d] >> CORRCC [n] ⇔ [t] nasals stand in correspondence with:
 ... voiced Cs >> voiceless Cs
- CORRCC [n] ⇔ [d] >> CORRCC [n] ⇔ [b] ... Cs w/same place >> Cs w/diff. place
- CORRCC [n] ⇔ [d] >> CORRCC [n] ⇔ [z] ... stops >> fricatives
- CORRCC [n] ⇔ [l, r] >> CORRCC [n] ⇔ [w, j] ... liquids >> glides

Interweaving IO-faithfulness into these fixed rankings creates the implicational universals about which classes of segments participate in LDCH

2. Proposal: contextual slips as one-time LDCH constraint re-rankings³

- 14) /'sɛ.ʃʌn/ → ['ʃɛ.ʃʌn] session
- /,pəːʒən fəː 'pəːs/ → /,pəːʒən fəː 'pəːʃ/ Persian for 'purse'

³ This section was inspired by a proposal in Krauss (2008), to whose author I am in debt.

15) Normal English pronunciation of 'session': preventing CH

/'sɛ.ʃʌn/ 'session'	CORR-[s] ⇔ [ʃ]	IDENT-IO [DISTRIBUTED]	IDENT-CC [DISTRIBUTED]
'sɛ.ʃʌn	*		
'sɛ.ʃʌn			*
'ʃkɛ.ʃʌn		*!	

Skimming over some learning details (feel free to ask later?):

- I propose that English learners, who don't get evidence of LDCH in the target grammar, rank these constraints as in (15)... *However, what if:*

16) Demotion of IO-faithfulness produces 'shession'

/'sɛ.ʃʌn/ 'session'	CORR-[s] ⇔ [ʃ]	IDENT-CC [DISTRIBUTED]	IDENT-IO [DISTRIBUTED]
'sɛ.ʃʌn	*!		
'sɛ.ʃʌn		*!	
'ʃkɛ.ʃʌn			*

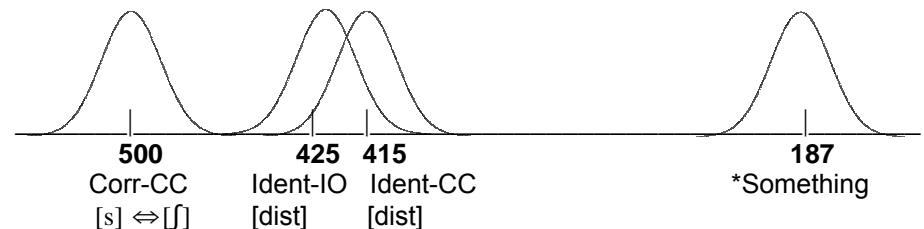
2.1 How to cause a one-time re-ranking: Stochastic Grammars

One easy and common method: stochastic OT of Boersma (1998), using the Gradual Learning Algorithm (see esp. Boersma and Hayes 2001)

Essential components here:

- constraints not ordinal points, but normal distributions along a number line

17) One stochastic version of 15) that English learners can acquire



- exact values of each constraint is chosen randomly every time grammar is used, from under its distribution curve:

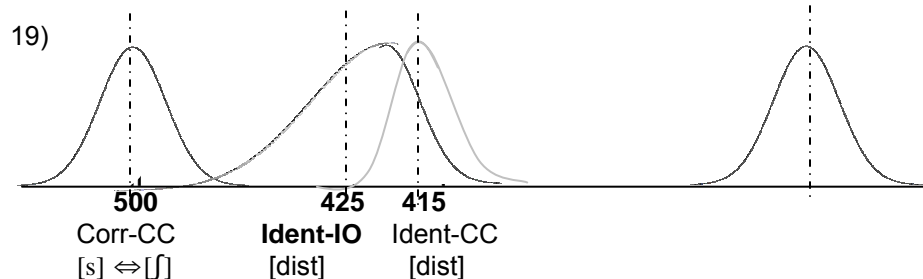
- 18) CORR-CC[s] ⇔ [ʃ] >> IDENT-IO [dist] >> IDENT-CC [dist]
- 501.3**
426
414.9

Distribution curves are asymptotic to zero:
any constraint value is, in principle, possible – most just not very likely

In (17): Ident-IO[dist] *usually* >> Ident-CC[dist] ... no LDCH
 Ident-CC[dist] *occasionally* >> Ident-IO[dist] ... a contextual slip

Many uses of stochastic phonologies:
 • especially in target grammars with variation, and in learning⁴

The idea here: positive asymmetric skew of IO-faith distributions (as in 19)
The upshot: the exact value of an IO-faith constraint is *more likely to be lower than higher* within its distribution on any iteration



The effect: ranking reversals of Ident-CC[F] and Ident-IO[F] will be more likely than others, despite *absence* of variation in the target

The hope: Simulations will tell which values, how much skew, etc. are right for fitting the proportions of contextual slips.

2.2 Connection to previous proposals in the literature

Hayes (2004): The idea of using an asymmetric bias lowering IO-faith, without needing evidence to do so, in order to learn morpho-phonological patterns after the initial stages.

Goldrick and Daland (in press): The idea of using a stochastic phonology to cause on-line errors to mirror grammatical tendencies (viz. segmental replacement errors that decrease markedness, e.g. k→t more than t→k)

⁴ A small subset of the literature: Boersma 1998, Boersma and Hayes 2001, Boersma and Levelt 2003, Apoussidou 2007, Jesney and Tessier 2007, Jaeger to appear; cf. Tessier 2009.

3. Why this proposal? The connections between LDCH and slips

3.1 Similarity

In *long-distance* nasal consonant harmony:

- targets are susceptible by virtue of *similarity to the trigger*

Recalling (12) and (13), Walker (2007) points out:

- [n] and [d] share [+voice], [-continuant] and [alveolar place] ... etc.
- [n] and [b] share [+voice] and [-continuant]

Using similarity to characterize triggers and targets is in sharp *contrast* to local nasal assimilation ('spreading'), illustrated below:

20) Local nasal assimilation in Malay (Ohn 1980, Cohn 1990, Walker 1998):

[māyān]	'stalk'	[mākan]	'eat'
[mēwāh]	'be luxurious'	[mālaran]	'forbid'
[māʔāp]	'pardon'	[mānāwān]	'to capture'

In *local* nasal assimilation:

- targets are susceptible due to *compatibility with spreading features*
- so (roughly): the more sonorous the sound, the better a target for local nasal assimilation (see esp. Walker 1998)

Contextual slips of the tongue, like LDCH, are all about similarity (Shattuck-Hufnagel and Klatt 1979, Stemberger 1991, Vousden et al 2000, Broecke et al 1980, Goldrick 2004, etc. etc.)

Experimental question: *Does similarity predict speech error rates and LDCH patterns in all the same ways?*

General similarity: Stemberger (1991a); Frisch (1996)

LD nasal agreement: Walker (2007)

English sibilants in particular: Krauss (2008)

(see also Rose and King (in press))

Results so far: *Yes. Certainly if we calculate similarity in the right ways.*

3.2 Other connections between LDCH and contextual slips

Directionality of harmony

LDCH: if not stem controlled, then R-to-L or all directions (Hansson 2001a)
Errors: other things being equal, anticipatory errors are usually far more common than perseveratory errors (e.g. Schwartz et al 1994; Dell et al 1997)

- 21) /de^j/ → [dʒe^j] of the [dʒækʰ] anticipation
 'televitie, uh... televisie' perseveration

In this proposal: directionality comes in both cases from *directional* IDENT-CC constraints (proposed by both Hansson & Rose and Walker)

Asymmetries between targets and intruders, most notably the 'palatal bias'

LDCH: typological facts summarized as below in Hansson (2001b)

- 22) Asymmetric sibilant harmony systems
- | | |
|---------------------------|---------------------------|
| $s \rightarrow \int$ only | $\int \rightarrow s$ only |
| 2 Athapaskan, | 1: Tlachichilco Tepehua |
| 1 Algic, 1 Mayan, | (Totonacan) |
| 4 Omotic, 1 Semitic, | |
| 2 Afroasiatic, 5 Bantu | |

Errors: also show palatal bias (e.g. Shattuck-Hufnagel and Klatt 1979; Stemberger 1991)

Stemberger (1991) corpus study:

- 65 errors where an alveolar was replaced by a palatal
- 38 errors where a palatal was replaced by an alveolar.

- 23)a) /s/ → ʃ: 22 errors vs. /ʃ/ → s: 8 errors
 b) /t/ → tʃ: 14 errors vs. /tʃ/ → t: 1 error

In this proposal: palatal bias comes in both cases from ranking feature-specific IDENT-IO constraints (Pater 1996):⁵

- 24) Ident-IO[+pal-alveolar] >> Ident-IO[-pal-alveolar]

⁵ Though cf Frisch (1996)'s arguments that the palatal bias is only about lexical neighbourhoods.

Part Two: Which comes first? Errors or LDCH?

4.1 Three Differing Predictions of the two approaches

25) *If LDCH constraints create speech errors (online)*:

- (i) then *any* LDCH constraint could in principle cause a speech error
...in fact any *markedness* constraint might do so
... though other pressure can (and surely do) also create errors
- (ii) relative rates of different errors must result from different inherent, or lang. specific, rankings of CORR-CC, IDENT-CC, IDENT-IO constraints
- (iii) children do not create, or at least do not *innovate*, the constraints that cause adult LDCH... so child-specific consonant harmonies needn't resemble speech errors in any systematic way

26) *If speech errors create LDCH constraints (over time)*:

- (i) then ANY error could in principle cause an LDCH constraint
... though other things can/will still create constraints
- (ii) relative typological frequency of different LDCH constraints must result (in the big picture) from inherent rates of errors
- (iii) since children are presumably the innovators of LDCH constraints, their *innovative* harmony constraints should be LDCH precursors

4.2 Do all LDCH constraints imply errors? I think so.

Hansson (2001b)'s list of kinds of long-distance consonant harmonies:

- (1) Examples of non-coronal CH phenomena discussed in Hansson (2001)
 - Nasal consonant harmony (nasals vs. oral stops/sonorants)
 - Voicing harmony (voiced vs. voiceless obstruents)
 - Stricture harmony (stops vs. fricatives, fricatives vs. affricates, etc.)
 - Dorsal consonant harmony (velars vs. uvulars)
 - Liquid harmony (laterals vs. rhotics, liquids vs. glides)
 - Secondary-articulation harmony (e.g., pharyngealized vs. plain sibilants)

Errors of each type are, I think, quite easy to find in corpora – with the exception of dorsal harmony and 2ndary articulation harmony, given English's segmental inventory (e.g. English has only velar dorsals)

4.3 Do all contextual errors imply agreement constraints? No.

Kinds of speech errors that are NOT phonologized
 (Error examples below from Stemberger 1989)

Type 1: Addition errors

27) Error examples

- a) 'Three drawers' [dʒaʊn] 'down'
 b) 'We have to bring sleeping' [brægʒ] 'bags'

28) Unattested (to my knowledge?): An affix that alternates between e.g. [i'la] and [i.'pla] depending on whether the root contains a [pl] cluster:

/bat + ila/ → [bati'la] /prat + ila/ → [plati'pla]
 /pinob + ila/ → [pi,nobi'la] /toplu + ila/ → [toplui'pla]

Type 2: Exchange errors

29) Error examples

- a) 'I got that [gɑʔ] for [pɹɪsməs] 'ball for christmas'
 b) 'Why don't we [staf] [ɑp]'... 'stop off'

30) Unattested: An affix that alternates between e.g. [i'la] and [i.'ra] depending on whether it *metathesizes* with a root [r]:

/bat + ila/ → [bati'la] /prat + ila/ → [plati'ra]
 /plinob + ila/ → [pli,nobi'la] /topru + ila/ → [toplui'ra]

Type 3: Repeated phoneme effect errors (see also Type 1) (Dell 1984, MacKaye 1970, Stemberger 1990)

31) *Dell (1984) Exp 2: Percentage of onset errors in SLIPS task*

Condition	Total % errors ⁶
Repeated V	8.0
Different Vs	4.5
Repeated coda Cs	6.3
Different coda Cs	2.4

⁶ In each condition, percentages are out of 288 total tokens.

32) Unattested: An affix that alternates between e.g. [i'la] and [i.'ra] depending on whether trigger/target are followed by identical vowels:

/bat + ila/ → [bati'la] /prat + ila/ → [plati'la]
 /prinob + ila/ → [pri,nobi'la] /topra + ila/ → [toplai'la]

C.f.: LDCH's complete *indifference* to intervening segments
 (see esp. Rose & Walker 2004 §2.3, Hansson 2001a)

4.4 Do child-specific harmony constraints look like pre-LDCH?

Child-specific consonant harmony is robustly attested in many languages and certainly very well studied in English (Smith 1973, Vihman 1978, Goad 1996, Pater 1997, Pater and Werle 2001 *interalia*)

From the current perspective (and as is well-acknowledged):

- child consonant harmony looks mostly like the *complement* of LDCH!

Place harmony in adult grammars targets *secondary place*:

- within dorsal (velar vs. uvular)
- within coronal (most notably sibilant harmony)
- palatalization harmony, pharyngealization harmony...

Child harmony in child grammars almost always targets *primary place*:

- dorsal harmony (e.g. 'duck' → [guk]: Trevor, Pater 1997)
- labial harmony (Clara: Rose 2000)⁷

33) Examples of Clara's regressive labial CH

	Word	Target form	Child's output	Age	Gloss
i) [Dor...Lab] 93% of potential targets	<i>Gaspard</i>	[gaspɑʁ]	[ba'pæ:]	1;03.07	'Gaspard'
	<i>capable</i>	[kɑpab]	[pa'pæb]	1;09.01	'capable'
	<i>café</i>	[kɑfe]	[pə'fe]	1;10.04	'coffee'
	<i>Gaspard</i>	[gaspɑʁ]	[pæ'pæ:]	2;00.02	'Gaspard'

⁷ Children do show both local AND non-local consonant harmonies: see e.g. Gwendolyn (Stemberger 1988, Hansson 2001a) whose labial harmony shows the strict influence of intervening blocking segments, and thus looks local, like Malay nasal assimilation in (20).

Reasonable argument:

- child CH targets primary Place features because that's how much Place children have!
- Hansson (2001) quoting Vihman (1978):

"It may be that s-f (and other combinations of the alveolar and palato-alveolar fricatives) represent, for adults, the same kind of difficulty that p - t, t - k, etc. apparently present for children." (p. 324)

- note also that many (L1 English-learning) children show nasal harmony (e.g. [minz] for 'beans', Menn 1983)

Empirical question:

At the stage of consonant harmony, do children have surface contrasts that could show evidence of other consonant harmonies?

Some evidence that the answer is yes: from Clara (Rose 2000)

34) Some of Clara's output at 1;07-1;10 (during labial harmony)

Word	Target	Child	Age	Gloss
'cafe'	ka'fe	pə'fɛ	1;10.04	coffee
'citrouille'	si'tʁuj	θə'tʁu:j	1;10.04	pumpkin
'dame'	dam	dam	1;07.27	lady
'capable'	ka'pab	ka'pæb	1;09.01	capable

Clara's outputs in (34) show:

- multiple labial PoA (p and f in *cafe*)
- multiple degrees of homo-org. stricture (t and θ in *citrouille*)
- multiple voicing values among homo-org. stops (p and b in *capable*)

In fact:

35) A possible pattern of local, not long-distance, coronal place harmony:

Word	Target	Child	Age	Gloss
'chien'	fjɛ	ɟjæ	1;07.27	dog
'sorcière'	sɔʁsjɑʁ	sɔɟjæ:	1;07.27	witch

(not ATB though: 'attention' = [ætɑ:sjɔ̃])

5. Tentative Conclusions

1. With the right structure of grammar and phonological knowledge, it is possible to understand long-distance consonant harmony as either the *cause* or the *result* of contextual slips of the tongue.
2. I have proposed pursuing the former option, in which a grammar's stochastic noise could produce the one-time re-rankings necessary to produce LDCH-like effects, construed as errors.
3. I have suggested some directions in which we could try to tease apart this proposal from the reverse idea, namely that LDCH constraints are in some way the result of erroneous speech planning.
4. The conclusion I draw from these investigation is that, at best, some very clever proposals will be necessary to understand how the 'phonologization' of speech errors could bring about all and only the attested facets of long-distance consonant harmonies.
5. ... not that I am the first to note this:
"[Earlier on], it was suggested that consonant harmony effects could be regarded, loosely speaking, as 'phonologized speech errors'. This phrase should not be taken too literally. Given how relatively rare errorful productions of a given word is, as compared to productions without error, it seems rather unlikely that sporadic on-line errors would be able to spawn regular sound changes, yielding systematic phonological patterns. [...] If considerations of planning and phonological encoding are involved in consonant harmony phenomena, as I have argued here, then this connection must hold at a relatively grammaticalized cognitive level." (Hansson 2001: 512)
6. Many further questions need answers – e.g., about how the present account interacts with the more 'performance' properties of speech errors, including the effects of task and wordhood...
7. ... and more data on the cross-linguistic facts of speech errors as well as child harmony patterns in other languages.

Thank you very much.

References

- Apoussidou, Diana. 2007. *The Learnability of Metrical Phonology*. Ph.D. dissertation, University of Amsterdam.
- Boersma, Paul. 1998. *Functional phonology: formalizing the interactions between articulatory and perceptual drives*. Ph.D. dissertation, University of Amsterdam.
- Boersma, Paul and Bruce Hayes. 2001. "Empirical tests of the gradual learning algorithm," *Linguistic Inquiry* 32: 45-86.
- Boersma, Paul and Claartje Levelt. 2000. "Gradual Constraint-Ranking Learning Algorithm Predicts Acquisition Order". *Proceedings of 30th Child Language Research Forum*, Stanford University. Stanford: CSLI.
- Cohn, Abigail. 1990. *Phonetic and Phonological Rules of Nasalization*. PhD dissertation, UCLA.
- Compton, A.J. and M. Streeter. 1977. Child Phonology: Data Collection and Preliminary Analyses. *Papers and Reports on Child Language Development 7*. Stanford, CA: Stanford University.
- Dell, G. S. 1984. Representation of serial order in speech: Evidence from the repeated phoneme effect in speech errors. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 10, 222-233.
- Dell, G. S. 1986. A spreading activation theory of retrieval in sentence production. *Psychological Review*, 93, 283-321.
- Dell, Gary S., Lisa K. Burger and William R. Svec. 1997. Language production and serial order: A functional analysis and a model. *Psychological Review* 104:123-47.
- Dereau, L. 1955. *Cours de Kikongo*. Namur: A. Wesmael-Charlier.
- Dressler, W. U. (1979). Experimentally induced phonological paraphasias. *Brain and Language*, 8,19-24.
- Frisch, Stefan. 1996. *Similarity and frequency in phonology*. Ph.D. dissertation, Northwestern University, Evanston, IL, USA.
- Frisch, Stefan, Janet Pierrehumbert and Michael Broe (2004). Similarity avoidance and the OCP. *Natural Language and Linguistic Theory*, 22, 179-228
- Gallagher, Gillian and Jessica Coon. 2008. Perception and contrast in laryngeal (dis)harmony. Poster. NELS 39, Cornell.
- Goldrick, M. and Daland, R. (in press). Linking speech errors and phonological grammars: Insights from Harmonic Grammar networks. *Phonology (Special issue on connecting theory and experimental methods)*
- Hansson, Gunnar. 2001. *Theoretical and typological issues in consonant harmony*. Ph.D. dissertation: University of California, Berkeley.
- Hansson, Gunnar. 2001b. 'The Phonologization of Production Constraints: Evidence from consonant harmony'. In M. Andronis, C. Ball, H. Elston and S. Neuvel (eds.) *CLS 37: The Main Session. Papers from the 37th Meeting of the Chicago Linguistic Society. Vol. 1*, pp. 187-200.
- Hayes, Bruce. 2004. Phonological Acquisition in Optimality Theory: the early stages. In Kager, Rene, Joe Pater & Wim Zonneveld,(eds.), *Fixing Priorities: Constraints in Phonological Acquisition*. Cambridge, U.K.: Cambridge University Press.
- Jäger, Gerhard. to appear. Maximum entropy models and stochastic Optimality Theory. In *Architectures, Rules, and Preferences: A Festschrift for Joan Bresnan*, ed. Jane Grimshaw, Joan Maling, Chris Manning, Jane Simpson & Annie Zaenen. CSLI Publications, Stanford
- Jesney, Karen and Anne-Michelle Tessier. 2007. Re-evaluating learning biases in Harmonic Grammar. In M. Becker (ed.) *UMOP36: Papers in Theoretical and Computational Phonology*. Amherst, MA: GLSA.
- Krauss, Marnie. 2008. *Speech errors as faithfulness constraint demotion: An ABC analysis*. M.Sc. Final Project, University of Alberta.
- MacKay, D. G. 1970. Phoneme repetition in the structure of languages. *Language and Speech*, 13, 199-213.
- McDonough, Joyce. 2003. *The Navajo Sound System*. Kluwer Academic Publishers, Dordrecht.
- Nevins, Andrew, and Bert Vaux. 2003. Metalinguistic, schmetalinguistic: The phonology of shm- reduplication. In *Proceedings of the Chicago Linguistic Society*, vol 39. Chicago: Chicago Linguistic Society.
- Onn, F. M. (1980). *Aspects of Malay phonology and morphology*. Bangi: Universiti Kebangsaan Malaysia.
- Pater, Joe. 1997. Minimal Violation and Phonological Development. *Language Acquisition* 6(3): 201-253.
- Rose, S., & King, L. (in press). Speech error elicitation and co-occurrence restrictions in two Ethiopian Semitic languages. *Language and Speech*.
- Rose, Sharon & Rachel Walker (2004). A typology of consonant agreement as correspondence. *Language*, 80, 475-531.
- Shattuck-Hufnagel, Stephanie, & D. H. Klatt, D. H. 1979. The limited use of distinctive features and markedness in speech production: Evidence from speech error data. *Journal of Verbal Learning and Verbal Behavior*, 18, 41-55.
- Shaw, Patricia. 1991. Consonant harmony systems: The special status of coronal harmony. *Phonetics and Phonology*, 2, 125-156.

- Stemberger, Joseph P. 1989. Speech errors in early child language production. *Journal of Memory and Language* 28:164-88.
- Stemberger, Joseph. 1990. Wordshape errors in language production. *Cognition* 35.2 123-157.
- Stemberger, Joseph. 1991. Apparent anti-frequency effects in language production: The addition bias and phonological underspecification. *Journal of Memory and Language*, 30, 161-185.
- Tessier, Anne-Michelle. 2004. Root-restricted Markedness and Morpho-Phonological Domains. Talk presented at the Montreal-Ottawa-Toronto Phonology Workshop, University of Ottawa.
- Tessier, Anne-Michelle. 2009. Frequency of Violation and Constraint-based Phonological Learning. *Lingua* 119 (1): 6-38.
- Vousden, J. I., Brown, G. D. A., & Harley, T. A. 2000. Serial control of phonology in speech production: A hierarchical model. *Cognitive Psychology*, 41, 101-175.
- Walker, Rachel. 1998. *Nasalization, Neutral Segments and Opacity Effects*. Ph.D. dissertation, UC Santa Cruz.
- Walker, Rachel. 2000a. Yaka nasal harmony: Spreading or segmental correspondence? *Proceedings of the Berkeley Linguistics Society*, 26, 321-332.
- Walker, Rachel. 2000b. Long-distance consonantal identity effects. *Proceedings of the West Coast Conference on Formal Linguistics*, 19, 532-545.
- Walker, Rachel. 2007. Nasal and oral consonant similarity: Exploring parallels with long-distance nasal agreement. *Language and Cognitive Processes* 22.7, 1-41.
- Zuraw, Kie 2000. 'Aggressive reduplication'. *Phonology* 19: 395-439