Some comments on the study of stress

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Personal history

- I got started out in phonology at MIT (1976-1980), working on stress rules.
- They are a tantalizing topic: complex, but not overwhelmingly so, and with many cross-linguistic resemblances.
- So, I did two theoretical/typological studies:
  - my MIT dissertation (1980)
  - a larger survey (*Metrical Stress Theory*, 1995), linking stress to a distinction of iambic vs. trochaic rhythm
- Since then, I've worked on other topics.

Plan of my talk: a laundry list

- Three topics concerning stress and phonological theory
- Some personal remarks about the MIT graduate program

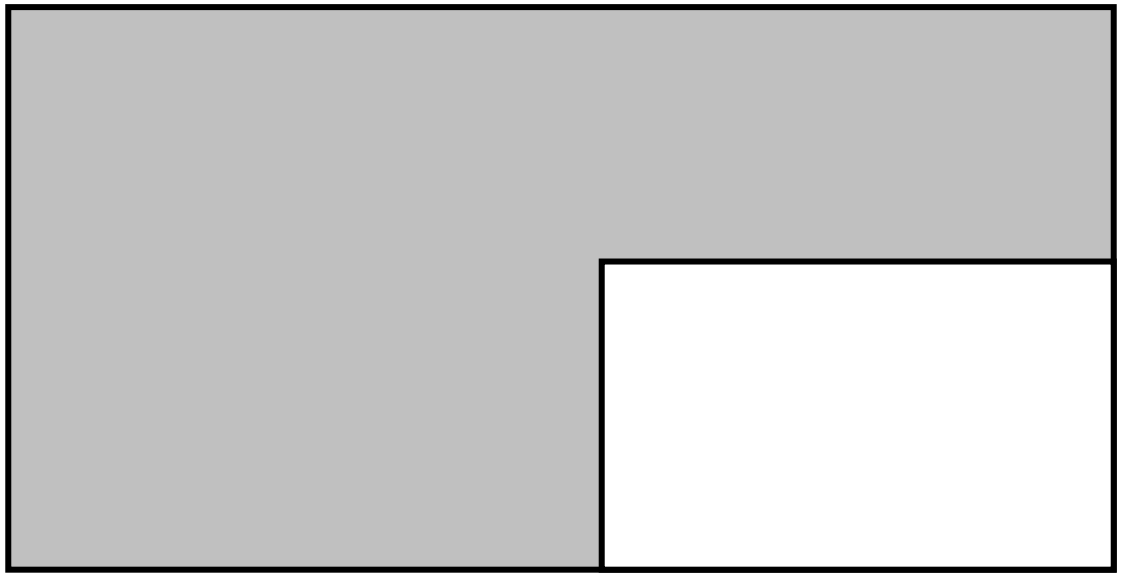
I. Stress, nested regions, and phonological theory

An important descriptive generalization

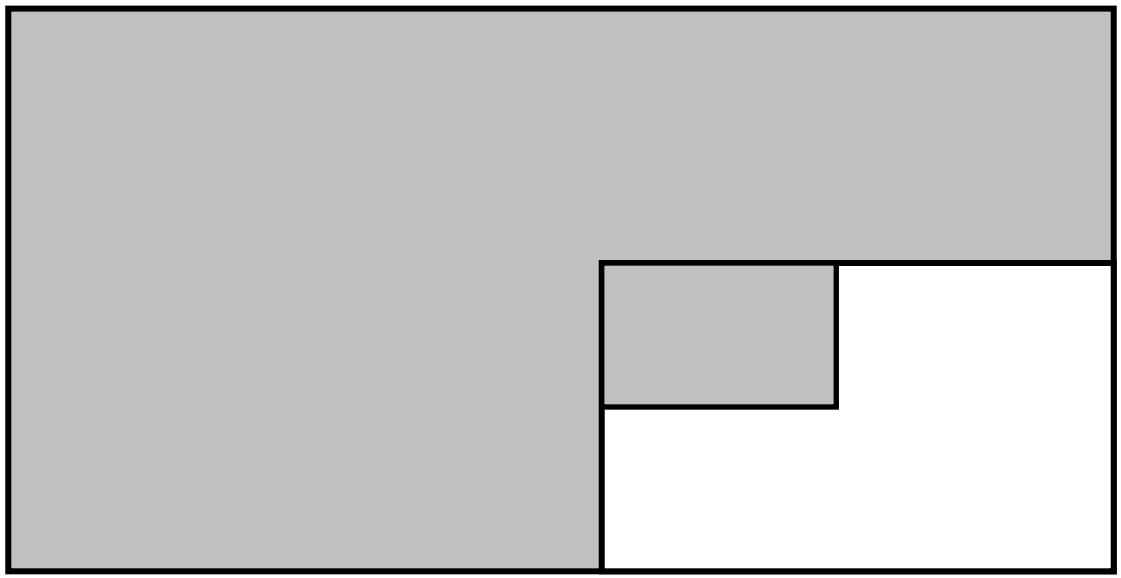
- Stress abounds in patterns that can be described with **nested regions** (Prince and Smolensky 1993, §4)

Use Pattern A in this environment

But in a subregion, use Pattern B instead



But in a sub-region of B, use A.



A real-life example: Finnish stress

- Sources: Hanson and Kiparsky (1996), Anttila (1997a, 1997b, 2008), Elenbaas (1999), Elenbaas and Kager (1999), Kiparsky (2003)
- Caution: data simplified to fit time limitations

Finnish stress: the basic pattern

- Initial main stress
- Alternating secondary stress going left to right—every other syllable, hence “binary”.
- Analysis: a left-to-right parse into trochaic metrical feet.

(jǽr jes)(tè le)(mæ̀ tø)(mỳ: des)(tæ̀n sæ)

‘from his lack of systematization’ (Kiparsky 2003, 111)

Stressless final syllables

- Final syllables are unstressed (analytically: not footed), going against the alternating pattern.

(ér go)(nò mi) ja

‘ergonomic-Nom. sg.’ Elenbaas and Kager p. 302

The effect of syllable quantity

- Exception to the alternation pattern: if a trochee would be of the form **Light + Heavy** (quantity mismatches stress), then you make a ternary, not binary interval.

H H L **H** **L** L H L
(vói mis) te **(lùt te)** le (màs ta)

'having caused to do gymnastics' Kiparsky (2003, 111)

L H
avoiding: *(té lut)

Initial stress always holds good

- L + H *is* made into a foot when this is needed to obtain initial stress:

L H L H L
(ká las) te (lèm me)
'we're fishing' K 2003, 111

Final stresslessness always holds good[1]

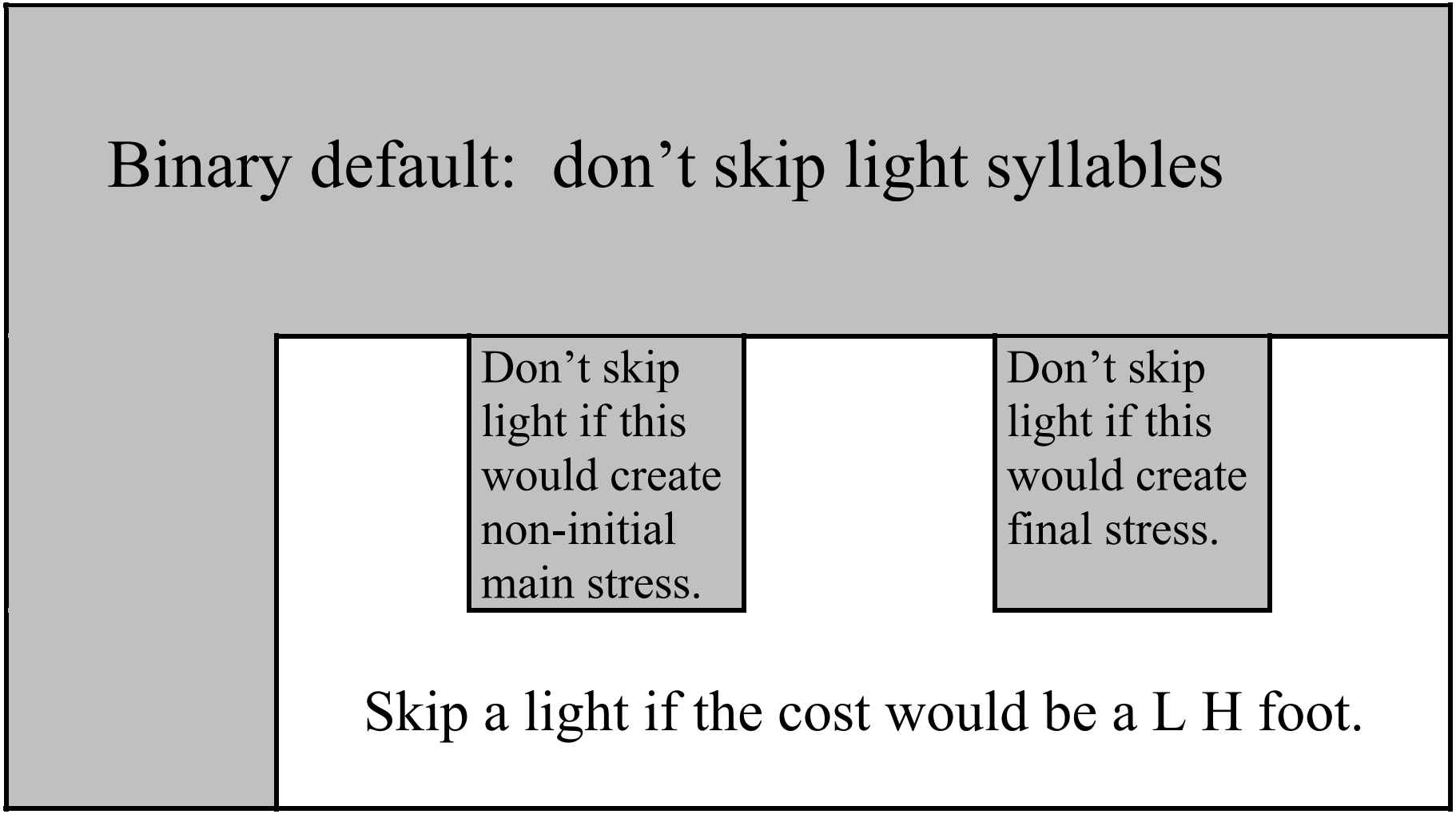
- Don't skip over a light if as a result you would get final stress:

L H **L H**
(rá vin)**(tò lat)**

'restaurants' Elenbaas and Kager 304

[1] Until later in the talk; be patient …

The “nested regions” for Finnish



There is more …

- Even non-finality is negotiable, since Finnish allows monosyllables and they are stressed.

(tá:s)

'again' K 2003, 147

- Anttila (1997, 2010) observes other reasons to skip lights, such as vowel height mismatches in the foot.

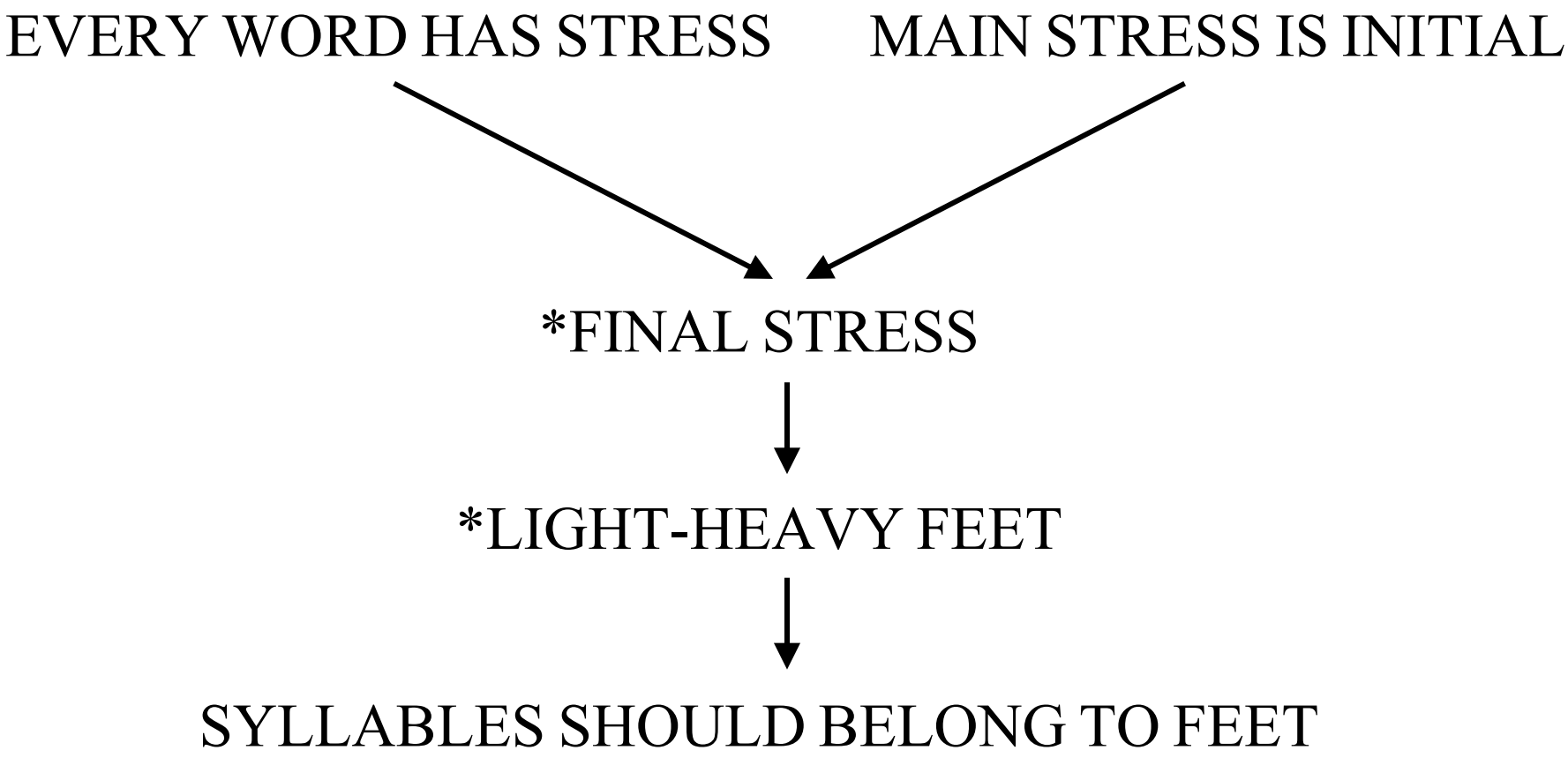
The merit of this kind of description

- All the complexity lies in the establishment of priorities.
- The "ingredients" of the system are
  - Simple
  - Well-justified typologically: *the principles at stake show up as **inviolable** in other languages*.

What I'm getting at

- Finnish stress is a nice example for **Optimality Theory** (Prince and Smolensky 1993 et seq.), which expresses in formal terms the reasoning just given.
- In OT, when all goes well, *complexity is the consequence of simple things prioritized*.
- For Finnish this would be expressed as in the Hasse diagram on the next slide.

Hasse diagram for Finnish (partial)



Finnish is representative, I think

- My own interest in OT developed because it resolved dilemmas implicit in the stress theory I was working on (1995, completed 1993).
- … and post-1993 study of stress in OT (a large literature) suggests that the Finnish example is not atypical.

Is OT problem-free?

- Of course not; there are many problems; conspicuously **opaque phonology** (Bromberger and Halle 1989, Idsardi 2000)
- OT is hard to apply to opaque systems while remaining faithful to its original insightful form.
- My take: *we don't understand the phonology of the opaque systems well enough*, particularly how they are internalized by language learners. Let's do some checking …

II. Stress research and “analytic corpora”

It should be easy to check formal theories against many languages—what is needed?

- My 1995 book (likewise Hayes 1980, Halle and Vergnaud 1987, Idsardi 1992) provides analyses of a large number of diverse languages.
- These books have been used—beneficially, I think—by subsequent theorists, essentially as **corpora**.
- The later theorist does not accept the older theory, but accepts the crucial data generalizations, which the older theory served to express.

Analytic corpora

- *Proposed definition*: an **analytic corpus** is a corpus of language-particular analyses, using a theoretical framework and focusing on some phenomenon in language.
- In particular, it not the same as a data corpus (though it will normally included illustrative data).

What might make for good analytic corpora?

- Scrupulous checking for all possible cases: e.g. in weight-based stress, you need to examine 2^n examples for words of *n* syllables.
- Web installation, for easy access and expansibility.
- Full explanation in prose of each system discussed.
- (Ideally) appended to each language in the analytical corpus: a searchable raw data corpus, so that the generalizations can be tested and refined.

What is the current situation re. analytic corpora?

- Not entirely bad; see partial list in Appendix to these slides.
- But I doubt there is any analytic corpus that fits all the criteria of the preceding slide.
- In phonology, there appear to be huge gaps: e.g. reduplication and vowel harmony are intensively theorized but have (I believe) nothing like an adequate analytic corpus.[2] It wouldn't be that hard…

[2] The closest I've seen is the Graz Database on Reduplication; http://reduplication.uni-graz.at/, but I think it is fair to call it a data corpus rather than an analytic one.

III. Recent developments in phonological theory: How stress has fit in

Learnability, UG and learning simulations

- A strong test of theories of Universal Grammar to deploy them in **computational modeling of language acquisition**.
- Long term goal: within at most a few centuries linguistics will achieve the **synthetic child**, who will learn the same grammars as human children and behave identically to humans under any form of testing.
- Stress has been the domain of some of the most interesting work attempting to learn phonology from data.

Stress and hidden structure

- **Hidden structure** (Tesar and Smolensky 2000): inaudible but crucially referred to in the grammar.
- A canonical case is the **feet** of metrical stress theory; inaudible but essential to the analysis.

(pá ta) (ká)	vs.	(pá) (ta ká)

- How to learn both hidden structure and constraint rankings at the same time?
- References: Tesar & Smolensky, Apoussidou and Boersma (2003), Jarosz (to appear)

Free variation in grammar

- Finnish is actually more complex than above.
- Many words have two possible stress patterns, e.g. from above, (rá vin)(tò lat) is actually:

> (rá vin)(tò lat) ~ (rá vin) to (làt)
>
> 'restaurants' EK 304

- Constraint-based grammars work well for describing this; they use **free ranking** (Anttila 1997; Elenbaas and Kager 1999, covering the Finnish case).

Beyond simple free variation: quantities and probabilities

- Free-ranking grammars often aim higher: actual **matching of probabilities**.
- In some variants, this means incorporating **mathematical apparatus** into the framework; e.g. stochastic OT (Boersma 1998), Noisy Harmonic Grammar (Boersma and Pater, to appear), maxent grammars (Goldwater and Johnson 2003)
- Empirically: experiments show that native speakers often **have accurate knowledge of the quantitative pattern**; see Hayes et al. (2009) for one example + literature survey.

IV. Some personal remarks about the MIT program

The role of the MIT department in the intellectual development of linguists

- For me, it was the value of speculative theory.
- This went against my natural inclinations and made a big difference in my thinking and my career.
- 99% + of all theoretical proposals fail; but the remaining 1% can make a big difference!
- So, what has always been important about the MIT department is its role in nurturing scholars to go out on a limb in theorizing about language.

Thank you

For advice in preparing this talk I would like to thank Janet Pierrehumbert and the participants in the UCLA Phonology Seminar.

A downloadable copy of these slides, with references included, is available at:

www.linguistics.ucla.edu/people/hayes/papers/HayesMITSlidesDec10.pdf.

Appendix: a few analytic corpora for phonology

Becker, Roy (2010) Acoustic typology of vowel inventories and Dispersion Theory: Insights from a large cross-linguistic corpus. Ph.D. dissertation, UCLA. http://www.linguistics. ucla.edu/research/55-ucla-phd-dissertations.html. (vowel systems, with formant data)

Cohn, Abigail (1993). A survey of the phonology of the feature [nasal]. *Working Papers of the Cornell Phonetics Laboratory* 8, 141-203. (nasal harmony)

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Moravcsik (Ed.), *Universals of human language* (Vol. 2, pp. 243–279). Stanford, CA: Stanford University Press. (consonant sequencing)

Maddieson, Ian (1984) *Patterns of Sounds*. Cambridge: Cambridge University Press. (phoneme inventories)

Miehlke, Jeff (on line) P-base. http://137.122.133.199/~Jeff/pbase/index.html ("several thousand sound patterns in 500+ languages")

Walker, R. 1998. Nasalization, Neutral Segments, and Opacity Effects. PhD dissertation, University of California, Santa Cruz. (nasal harmony)

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Idsardi, William J. 1992. The computation of prosody. Ph.D. dissertation, MIT.

Idsardi, William (2000) Clarifying opacity. *The Linguistic Review* 17: 337-350.

Jarosz, Gaja (to appear) Naive Parameter Learning for Optimality Theory - the Hidden Structure Problem. To appear in *Proceedings of the 40th Annual Meeting of the North East Linguistic Society*.

Kiparsky, Paul (2003) Finnish noun inflection. In Diane Nelson and Satu Manninen, eds., *Generative Approaches to Finnish and Saami Linguistics*. Stanford, CA: CLSI Publications.

Prince, Alan and Paul Smolensky (1993) *Optimality Theory: Constraint Interaction in Generative Grammar*. Ms., published 2004: Blackwell, Oxford.

Tesar, Bruce and Paul Smolensky (2000). *Learnability in Optimality Theory*. Cambridge: MIT Press.