24.901 Phonological Constraints and Optimality Theory

1. Optimality Theory (Prince & Smolensky 1993, 2003)

- partially successful solution to the constraint problem
- received model of phonolgical theory in generative grammar today

- two constraint types
  markedness: structural well-formedness of output: *ü, Onset, *Lapse
  faithfulness: correspondence relation between input and output assumed
    Max: every segment of input has correspondent in output
    Dep: every segment of output has correspondent in input
    Ident-[feature]: two corresponding segments have same value for feature F

- constraints are **violable** (not always true of surface output) and **conflicting**
- conflict resolved by **ranking**
- **typology** by ranking: all systematic differences between grammars arise from different ranking of a fixed set of UG constraints
  - every language must fall in the class of possible rankings
  - every ranking describes a possible language
- what is carried over from traditional generative model:
  - input-output mapping
  - autosegmental, prosodic representations (OT is not a theory of representations though proposed constraints may have representational commitments)
- what is not carried over:
  - no rules
  - no constraints on inputs (morpheme-structure constraints)

2. **architecture** of model

Gen(erate) -> $cand_1$ -> Con -> $cand_x > cand_y > cand_z > \ldots$
$cand_2$
$cand_3$
:

- for each input GENerate constructs a (possibly) infinite set of output candidates
- the constraints (in a fixed ranking) **evaluate** the candidates by assessing violation marks
- the **output** for a given input is defined as the candidate that best satisfies the constraint hierarchy
- winner-take-all: a candidate's value is not improved relative to another by performing better on lower ranked constraints
- **tableau** is a device analogous to a truth table to prove that one candidate is more optimal (harmonic) than another

3. simple exemplifications: word-final consonant clusters of rising sonority

English: thea[tər] (cf. theatr-ic)
Canadian Fr: théat[ ]
Cont Fr: théa[tr]

Son-Seq: *final clusters of rising sonority
Max-C: violation: a cons in input without correspondent in output
Dep-V: violation: a vowel in output without correspondent in input

/theatr/	Son-Seq	Max-C	Dep-V
thea[tər]			*
théa[t]		*	
théa[tr]	*		

- **English**: Son-Seq, Max-C >> Dep-V

/theatr/	Son-Seq	Max-C	Dep-V
-> thea[tər]			*
théa[t]		*!	
théa[tr]	*!		

- **Can Fr**: Son-Seq, Dep-V >> Max-C

/theatr/	Son-Seq	Dep-V	Max-C
thea[tər]		*!	
-> théa[t]			*
théa[tr]	*!		

- **Cont Fr**: Max-C, Dep-V >> Son-Seq

/theatr/	Max-C	Dep-V	Son-Seq
thea[tər]		*!	
théa[t]	*!		
-> théa[tr]			*

Observations
- Continental Fr has the faithful mapping: input same as output; hence F >> M
- To compel a change some M constraint must dominate some F constraint
- Minimal violation: /théatr/ -> théa[ ] also satisfies Son Seq but with an unneccessary violation of faithfulness (cf. economy, least effort)

4. Lyman's Law >> Rendaku (blocking)

/hana-sono/	Lyman's Law	Rendaku
hana-sono		*!
>hana-zono		

/aka-sabi/	Lyman's Law	Rendaku
>aka-sabi		*
aka-zabi	*!	

5. *'V.CV, *Coda-h >> Max-h (triggering)

/véhicl/	*'V.CV	*Coda-h	Max-h
vé.hi.cl	*!		
véh.i.cl		*!	
>vé.i.cl			*

6. The OT model assumes a one-step mapping between the input and output (parallelism)
   - challenged by pervasive opacity where a sound change is defined over a context that is not present in the surface output (e.g. *writer-rider*)
   - remains an unsolved problem; Harmonic Serialism (McCarthy, UMass) and OTLP (Kiparsky, Stanford) are alternative approaches that try to confront opacity

[0] Stress

- Focus of generative study since SPE
- Basic parameters known: 510 lgs. by Rob Goedemans http://www.unileiden.net/stresstyp/
- pervasive effects on phonology: allophony (a[r]om vs. a[t^h]omic, consti[t]ute vs. consti[t_]uent),Truncation (Elizabeth -> Liz, *Zab), Intonation contour
- Gordon (2002) lgs with one stress per word in a fixed position

TABLE II

Number of single stress languages

	Hyman (1977)		Present survey	
	Number of lgs.	%[3]	Number of lgs.	%[4]
Initial	114	37.3	57	30.2
Penultimate	77	25.2	53.5[5]	28.8
Final	97	31.7	59.5	32.0
Antepenultimate	6	2.0	7	3.7
Peninitial	12	3.9	10	5.3
Total	306		187	

initial: Czech, Irish, Latvian, Icelandic
final: Farsi, Hatian Creole, Kazakh, Kabardian
penultimate: Swahili, Polish, Albanian, Chamorro
antepenultimate: Macedonian,
peninitial: Lakota

[1] SPE model: [±stress]

- unique properties (cf. [±nasal]
- no invariant phonetic correlates: intensity, duration, pitch
- greater than binary distinctions: Arkansas vs. Tennessee; preliminary vs. assimilation
- never assimilated
- striking nonlocality: Creek: ifá, hicíta, amifocí, imahicíta, isimahicitá, itiwanayipíta
- rhythmic: repetition of a motif: 'Apal'achic"ola, cf. Finnish, Australian
- heavy syllables attract stress: CVV (heavy), CV (light), CVC (variable)
- culminativity: one syllable per word/phrase singled out as strongest

[2] Liberman 1975:

- stress is not a feature
- reflects abstract prominence modeled in **metrical grid**
- two dimensional array of positions and prominence
- phonetic rules interpret the grid by assigning length, F0, intensity

```
line-2    *            *                  *
line-1    *            *    *        *    *
line-0  * * * *        *  *  *       *  *  *
        America      hurricane     Tennessee
```

Metrical Models

1. "**grid-only**" (Prince '83, Selkirk '84, Goldsmith '93, Gordon '02): stress as rhythmic alternation of peaks and troughs in prominence grid with no internal grouping.

Hayes '81 typology of alternating stress:

Maranungku	"s s 's s	"s s 's s 's	"s = main stress
Warao	's s "s s	s 's s "s s	's = secondary stress
Weri	s 's s "s	's s 's s "s	s = syllable
Araucanian	s "s s 's	s "s s 's s	

x x x

- primitive rhythmic alternation of peaks and troughs: ....x x x x x x x .....
- parameters of initial association to {peak/trough} and {left/right} edge of word;
- one-to-one mapping of remaining syllables

Maranungku:	peak-first, left-to-right
Warao:	trough-first, right-to-left
Weri:	peak-first, right-to-left
Araucanian:	trough-first, left-to-right

"Grid-only" model abandoned in face of empirical arguments for grouping on the basis of stress shifts under deletion and insertion of vowels and conceptual arguments for particular types of rhythm.

2. Alternative **foot** theory: stress reflects a parsing of syllables into asymmetric units called feet. There are two basic types of feet: a **trochee** in which the first element is strong and the second weak and an **iamb** in which the first is weak and the second strong. Feet are optimally disyllabic but a monosyllabic foot can be created as a marked option.

x		x		x	
(x x)	trochee	(x x)	iamb	(x)	degenerate

- Maranunku: left-to-right trochaic parse; degenerate foot option exercised
- Warao: right-to-left trochaic parse; degenerate foot option not taken
- Weri: right-to-left iambic parse; degenerate foot option taken
- Araucanian: left-to-right iambic parse; degenerate foot option not taken
- Pintupi: left-to-right parse; degenerate foot option not taken
- Passamaquoddy: right-to-left iambic parse; degenerate foot option not taken

Evidence for grouping

3. stress shifts resulting from deletion of stressed syllable

> Central Yupik: stress syllables with a long vowel and initial syllables closed by a consonant; otherwise assign alternating left-to-right pattern to remaining syllables.
>
> qayáni 'his own kayak', sagúyáani 'in his (another's) drum', qayápigkáni 'his own future authentic kayak', qánrútkaqa 'I speak about them' < /qánrutékaqa/ by deletion of stressed vowel and retraction of stress to the left--not to the right where it might otherwise be expected. (Jacobson '85: 30-34)

	x		x x
x x x	(x x) x	x x x x x	(x x)(x x) x

qayani -> qayapigkani ->

```
                x   x          x      x
qanrutekaqa     x x x x x      ( x ) (x x) x x
                   ◥▲
                    _0
```

4. quantity changes to yield a bimoraic foot

- Latin –io verbs (Mester 1994)

aud-i:-mus	'hear'	root + theme + desinence	i: ≈ i
sent-i:-mus	'feel'		
aper-i:-mus	'open'		
sepel-i:-mis	'bury'		
cáp-i-mus	'catch'		
fác-i-mus	'make'		

  - allomorphs distributed to promote exhausative parsing

5. **Rhythmic Units** (WS iambic and SW trochaic and their relationship to quantity) Hayes '85, '94, McCarthy & Prince '86.

rhythmic perception: Woodrow 1909,…
- alternating pulses enhanced by intensity group SW
- alternating pulses enhanced by duration group WS

rhythmic **templates**

syllabic trochee: ('ss) and possibly ('s) as a marked option
iamb: (L's) and ('H): [i.e. (L'L), (L'H), and ('H)]
quantitative trochee:('LL) and ('H)--not ('HL) or ('L)--strictly bimoraic

7. Cairene Arabic:

light	CV	
heavy:	CVV, CVC	
super-heavy:	CVVC, CVCC	(limited to final syllable)

- classical pronunciation (Al-Azrah University)

shájara	?adwiyatúhu
shajarátun	?adwiyatúhumaa
shajarátuhu	
shajaratuhúmaa	

darábt ?a9máal
mustáshfaa, mu9állim, muqáatil, shaabáatun
kaatába, qattálat, maktábah, wálad, rá?aa, híya, kátaba, ?inkásara, bulahníyatun, murtabiTátun

- left-to-right moraic trochee parse with main stress on final foot
- final mora is extrametrical

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