Today's topics:

- **Factorial typology**
- **Segmental distribution**

Background preparation:

- McCarthy (2008), sec 2.8 (from last time)

0. Today's objectives

After today's class, you should be able to:

- Explain the importance of ROTB in an OT analysis of complementary distribution *(review)*
- Define factorial typology and use it to determine the typological predictions of a constraint set
- Assess our approach to complementary distribution using the predictions of factorial typology
  - Demonstrate and assess the patterns of segmental distribution that we predict

1. Warm-up: Predictable patterns and ROTB

- What is meant by **Richness of the Base** (ROTB)?

1. Warm-up: Predictable patterns and ROTB

- **Richness of the Base** (ROTB): There are no language-particular restrictions on input forms
  - If something is a possible input in one language (such as /CVC/), it is a **possible input in all languages**
  - **Hypothetical inputs**, that don't correspond to actual URs of the language, may be needed in order to **test** the grammar's ability to rule out ungrammatical forms
- **Predictable** info: **enforced by the grammar**
  - This means that predictable information is enforced by the **constraints** as they are **ranked** in a particular language

1. Warm-up: Predictable patterns and ROTB

- *Last time:* What are the implications of ROTB for patterns of **complementary distribution**?

1. Warm-up: Predictable patterns and ROTB

- What kind of **descriptive generalization** can we make about the Spanish data set in McCarthy (2008), sec 2.8, ex (30)?
  - Voiced fricatives appear after [+approx]
  - Voiced stops appear elsewhere

- *Last time:* Propose constraints analogous to those for Yoruba, Madurese nasalization patterns (p 91)
  - What ranking did we need for Spanish?
  - Today's focus:
    What are the **cross-linguistic (typological) consequences** of proposing these constraints?

2. Review: ROTB & complementary distribution

- **Descriptive generalization**
  - Voiced fricatives appear after [+approx]
  - Voiced stops appear elsewhere

- What constraints did we propose to model this?

2. Review: ROTB & complementary distribution

- How can we make the right candidates win?

/aba/			
(a) [aba]			
→ (b) **[aβa]**			

/βa/			
(a) [βa]			
→ (b) **[ba]**			

- Note the key role of **ROTB** here

2. Review: ROTB & complementary distribution

- What constraints did we propose for modeling complementary distribution in Spanish?
  - **F** constraint on the allophone **difference**:

    IDENT[±cont]
  - **M** constraint forcing **context-specific** allophone

    ***VD** ‘assign one * for every **sequence** of segments [+approx] [–son, –cont, +voi]’
  - **M** constraint forcing the **elsewhere** allophone

    ***VOIFRIC** ‘assign one * for every **segt** [–son, +cont, +voi]’

3. Factorial typology

- So far, we have focused on how to analyze the phonology of a single language using OT

- But: The OT analysis of one language **automatically makes predictions** about cross-linguistic phonological patterns (much more so than in rule-based phonology)
  - Why?

3. Factorial typology

- The OT framework includes the proposal that **constraints are universal**
  - Any constraint we introduce for the analysis of *one* language is automatically predicted to be included in the constraint set of *every* language

- Thus: The OT analysis of one language **makes predictions** about the range of possible cross-linguistic patterns

3. Factorial typology

- We can examine the **factorial typology** of a set of constraints to **determine its predictions**
  (Prince & Smolensky 1993)
  - What is the *factorial typology* of a constraint set?
  - Why is it called that?

3. Factorial typology

- We can examine the **factorial typology** of a set of constraints to **determine its predictions**
  (Prince & Smolensky 1993)
  - The factorial typology of a set of constraints is the set of **all rankings** of those constraints
  - If we have *n* constraints, there are *n!* ("*n* factorial") ways to rank them

    n! = (*n*) * (*n*-1) * (*n*-2) * ... * 1
  - Question: To what extent can/should factorial typology **match** the typology of observed languages?
    (→ see below)

3. Factorial typology

- Once we know the different possible rankings of a set of constraints, we can look at **what kinds of outputs will win** under each of the rankings

  Reminder: This is a different way of using a tableau

  - Until now, we have known the **input** and the **output**, and our goal was to determine what **ranking** was necessary to make that output win
  - Now, we know the **ranking** and the **input**, and we want to know what **output** will be the winner

4. Factorial typology of segmental distribution

- What is the **factorial typology** of these constraints?

  IDENT[±cont]

  *VD ‘assign one * for … [+approx] [–son, –cont, +voi]’

  *VOIFRIC ‘assign one * for … [–son, +cont, +voi]’

  - How many **possible rankings** are there? What are they?
  - Given /ba/, /βa/, /aba/, and /aβa/, what wins under each of the rankings?
  - What **distribution patterns** are predicted for the segments [b] and [β] under each ranking?

4. Factorial typology of segmental distribution

- How many rankings are there for these three constraints? ***VD, *VoiFric, Ident[±cont]**

3! = 6 rankings

1	*VD	»	*VoiFric	»	Id[±cont]	*(= Spanish)*
2	Id[±cont]	»	* VoiFric	»	*VD	
3	Id[±cont]	»	*VD	»	* VoiFric	
4	*VD	»	Id±cont]	»	* VoiFric	
5	*VoiFric	»	*VD	»	Id[±cont]	
6	*VoiFric	»	Id[±cont]	»	*VD	

4. Factorial typology of segmental distribution

- Ranking (1): *VD » *VoiFric » Ident[±cont]
  (this is the ranking for Spanish)

/ba/	*VD	*VoiFric	Ident[±cont]
→ (a) **[ba]**			
(b) [βa]		*!	*

/aba/	*VD	*VoiFric	Ident[±cont]
(a) [aba]	*!		
→ (b) **[aβa]**		*	*

4. Factorial typology of segmental distribution

- Ranking (1): *VD » *VoiFric » Ident[±cont]
  (this is the ranking for Spanish)

/aβa/	*VD	*VoiFric	Ident[±cont]
→ (a) **[aβa]**		*	
(b) [aba]	*!		*

/βa/	*VD	*VoiFric	Ident[±cont]
(a) [βa]		*!	
→ (b) **[ba]**			*

4. Factorial typology of segmental distribution

- Ranking (1): *VD » *VoiFric » Ident[±cont]
  (this is the ranking for Spanish)
  - Outcomes:

    /ba/ → **[ba]** /βa/ → **[ba]**

    /aba/ → **[aβa]** /aβa/ → **[aβa]**

  - Distribution:

4. Factorial typology of segmental distribution

- Ranking (1): *VD » *VoiFric » Ident[±cont]
  (this is the ranking for Spanish)
  - Outcomes:

    /ba/ → **[ba]** /βa/ → **[ba]**

    /aba/ → **[aβa]** /aβa/ → **[aβa]**

  - Distribution: **complementary** (predictable)
    - Faithfulness is lowest — choice of /b/ vs. /β/ in input has *no influence*
    - Context-specific M » context-free M — environment determines [b] vs. [β]

4. Factorial typology of segmental distribution

- What about all the other candidates?
  - **Other constraints** » *VoiFric, Id[±cont] in Spanish
  - For the rest of the discussion, we will keep our focus on languages where such other constraints dominate the constraints under discussion
  - Why? Only because we are interested in **how constraints can predict distribution patterns between two segments** like [b], [β]
    - Other ways to satisfy *VoiFric, *VD are also predicted to occur! — that's just a separate discussion topic

4. Factorial typology of segmental distribution

- What happens when we do the same thing for all the other rankings in this factorial typology?

/ba/	*VD	*VoiFric	Ident[±cont]
(a) [ba]			
(b) [βa]		*	*

/aba/	*VD	*VoiFric	Ident[±cont]
(a) [aba]	*		
(b) [aβa]		*	*

4. Factorial typology of segmental distribution

- What happens when we do the same thing for all the other rankings in this factorial typology?

/aβa/	*VD	*VoiFric	Ident[±cont]
(a) [aβa]		*	
(b) [aba]	*		*

/βa/	*VD	*VoiFric	Ident[±cont]
(a) [βa]		*	
(b) [ba]			*

4. Factorial typology of segmental distribution

- Ranking (2): IDENT[±cont] » *VOIFRIC » *VD
- Ranking (3): IDENT[±cont] » *VD » *VOIFRIC
  - Outcomes:

/ba/	→	/βa/	→
/aba/	→	/aβa/	→

4. Factorial typology of segmental distribution

- Ranking (2): IDENT[±cont] » *VOIFRIC » *VD
- Ranking (3): IDENT[±cont] » *VD » *VOIFRIC
  - Outcomes:

    /ba/ → **[ba]** /βa/ → **[βa]**

    /aba/ → **[aba]** /aβa/ → **[aβa]**

  - Distribution:

4. Factorial typology of segmental distribution

- Ranking (2): IDENT[±cont] » *VOIFRIC » *VD
- Ranking (3): IDENT[±cont] » *VD » *VOIFRIC
  - Outcomes:

    /ba/ → **[ba]** /βa/ → **[βa]**

    /aba/ → **[aba]** /aβa/ → **[aβa]**
  - Distribution: **contrastive** (unpredictable)
    Note the presence of "minimal pairs"!
    - Faithfulness is highest — input /b/ and /β/ both survive unchanged, no matter what
  - What is/are morpheme UR(s) here? Can we tell?

4. Factorial typology of segmental distribution

- Ranking (4): *VD » IDENT[±cont] » *VOIFRIC
  - Outcomes:

/ba/	→	/βa/	→
/aba/	→	/aβa/	→

4. Factorial typology of segmental distribution

- Ranking (4): *VD » IDENT[±cont] » *VOIFRIC
  - Outcomes:

    /ba/ → **[ba]** /βa/ → **[βa]**

    /aba/ → **[aβa]** /aβa/ → **[aβa]**

  - Distribution:

4. Factorial typology of segmental distribution

- Ranking (4): *VD » IDENT[±cont] » *VOIFRIC
  - Outcomes:

    /ba/ → **[ba]** /βa/ → **[βa]**

    /aba/ → **[aβa]** /aβa/ → **[aβa]**

  - Distribution: **neutralization**

    Note "minimal pair" [ba] ≠ [βa], but /aba/→[aβa]

    - *VD: 'special' segment in special context
    - Otherwise, faithfulness prevails
  - What is/are morpheme UR(s) here? Can we tell?

4. Factorial typology of segmental distribution

- Ranking (5): *VoiFric » *VD » Ident[±cont]
- Ranking (6): *VoiFric » Ident[±cont] » *VD
  - Outcomes:

/ba/	→	/βa/	→
/aba/	→	/aβa/	→

4. Factorial typology of segmental distribution

- Ranking (5): *VoiFric » *VD » Ident[±cont]
- Ranking (6): *VoiFric » Ident[±cont] » *VD
  - Outcomes:

    /ba/ → **[ba]** /βa/ → **[ba]**

    /aba/ → **[aba]** /aβa/ → **[aba]**
  - Distribution:

4. Factorial typology of segmental distribution

- Ranking (5): *VoiFric » *VD » Ident[±cont]
- Ranking (6): *VoiFric » Ident[±cont] » *VD
  - Outcomes:

    /ba/ → **[ba]** /βa/ → **[ba]**

    /aba/ → **[aba]** /aβa/ → **[aba]**
  - Distribution: **"inventory gap"** (illegal segment)
    Note that there is no [β] in any output ever
    - 'Special' segment is banned, regardless of context and regardless of input
    - This is how OT handles **absent** segments

4. Factorial typology of segmental distribution

- **Summary** of rankings and distribution patterns:

(1)	*VD » *VoiFric » Ident[±cont]	predictable
(2)	Ident[±cont] » *Cor-Dors » *VD	contrastive
(3)	Ident[±cont] » *VD » *VoiFric	
(4)	*VD » Ident[±cont] » *VoiFric	neutralization
(5)	*VoiFric » *VD » Ident[±cont]	inventory gap
(6)	*VoiFric » Ident[±cont] » *VD	

Faithfulness | Context-specific M | Context-free M

4. Factorial typology of segmental distribution

- Implications of the OT approach to segmental distribution:
  - If some language has a context-specific allophone and a default (“elsewhere”) allophone…
  - …which one is predicted to be an illegal segment in another language?

- Rule-based phonology cannot make this connection

5. Summary: Segmental distribution in OT

- General ranking for **predictable distribution**:
  Context-specific M » Context-free M » F
- General ranking for **contrastive distribution**:
  F » { Context-specific M , Context-free M }
- General ranking for **neutralization**:
  Context-specific M » F » Context-free M
- General ranking for **inventory gap**:
  Context-free M » { Context-specific M , F }

  → One lg's **specific allophone** is another lg's **gap**!

6. For next time

- Next time, we will look more carefully at **formalism** and **justification** for
  - Faithfulness constraints (see reading)
  - Markedness constraints (class discussion)