

## *Today's topics:*

- **Review for OT quiz**
- **Use factorial typology to predict possible languages**

---

## *Background preparation:*

- *Quiz information and review guide*

# 0. Today's objectives

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

- Prepare confidently for the OT analysis quiz
- Use the concept of factorial typology to test the predictions of a set of constraints
  - Generate the factorial typology for a set of constraints
  - Determine what kinds of languages it predicts
  - Consider whether they are plausible

# 1. OT quiz check-in

- OT quiz [information and review guide](#)
  - Any questions about structure or format?
  - Any questions about content?
- For practice and discussion, if needed:
  - Data set – [Cairene Arabic](#)

## 2. Warm-up: Working with tableaux

- How do we use an OT tableau to **figure out the constraint ranking** in a particular language (working from a data set)?
  - What do we know?
  - What do we need to figure out?

## 2. Warm-up: Working with tableaux

- How do we use an OT tableau to **figure out the constraint ranking** in a particular language (working from a data set)?
  - What do we know?
    - the **winning output**; the **input** (proposed)
  - What do we need to figure out?

## 2. Warm-up: Working with tableaux

- How do we use an OT tableau to **figure out the constraint ranking** in a particular language (working from a data set)?
  - What do we know?
    - the **winning output**; the **input** (proposed)
  - What do we need to figure out?
    - how the constraints are **ranked**
- How do we do this?

## 2. Warm-up: Working with tableaux

- How do we use an OT tableau to **figure out the constraint ranking** in a particular language (working from a data set)?
  - What do we know?
    - the **winning output**; the **input** (proposed)
  - What do we need to figure out?
    - how the constraints are **ranked**
  - How do we do this?
    - find informative losers
    - make valid ranking arguments (add W/L!)

## 2. Warm-up: Working with tableaux

- How do we use an OT tableau to **predict which output candidate wins** for a certain input in a certain language (whose grammar we know)?
  - What do we know?
  - What do we need to figure out?

## 2. Warm-up: Working with tableaux

- How do we use an OT tableau to **predict which output candidate wins** for a certain input in a certain language (whose grammar we know)?
  - What do we know?
    - the constraint **ranking**; the **input** of interest
  - What do we need to figure out?

## 2. Warm-up: Working with tableaux

- How do we use an OT tableau to **predict which output candidate wins** for a certain input in a certain language (whose grammar we know)?
  - What do we know?
    - the constraint **ranking**; the **input** of interest
  - What do we need to figure out?
    - which **output candidate** is optimal (“the best”) according to the ranking
  - How do we do this?

## 2. Warm-up: Working with tableaux

- How do we use an OT tableau to **predict which output candidate wins** for a certain input in a certain language (whose grammar we know)?
  - What do we know?
    - the constraint **ranking**; the **input** of interest
  - What do we need to figure out?
    - which **output candidate** is optimal (“the best”) according to the ranking
  - How do we do this? For each constraint, check:
    - Which candidate(s) do *best* on this constraint?
    - Is only one candidate left? | No? Go to next constraint

## 2. Warm-up: Working with tableaux

- Using a tableau to **predict** the output, given the ranking and the input
  - Do we add W/L marks when figuring this out?
- Which output wins, if  $A \gg B \gg C$ ?

/input/	A	B	C
(a) output1	*		
(b) output2		*	*
(c) output3		*	

## 2. Warm-up: Working with tableaux

- Using a tableau to **predict** the output, given the ranking and the input (No W/L this time!)
- Which output wins, if  $A \gg B \gg C$ ?

/input/	A	B	C
(a) output1	*!		
(b) output2		*	*!
→ (c) output3		*	

- Optional: Use ‘!’ when the ranking is **known**, to show what violation **makes** a candidate lose

### 3. Factorial typology

- In OT, because the **constraints are universal...**
  - whenever we propose a constraint in the analysis of one language,
  - we are automatically proposing that this constraint is found in all languages
- Consider the **typological implications** of a constraint we are using in an analysis:
  - If this constraint is found in all languages,
  - and could potentially be ranked high or low,
  - are we making inaccurate **predictions?**

### 3. Factorial typology

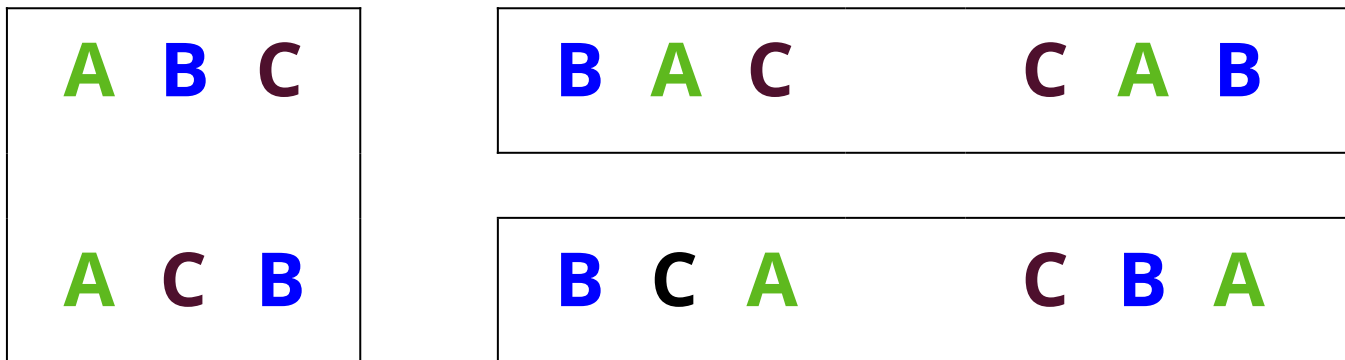
- How do we **test** the typological implications (=predictions) of a proposed set of constraints?
  - Consider **all possible rankings**
  - Consider *what kind* of language each ranking would predict
  - Evaluate whether such languages are plausible
- This is obviously a very large undertaking
  - Typically, we consider the predictions of a small set of relevant constraints at a time
  - (There is also OT analysis software to help with this!)

### 3. Factorial typology

- How many **possible rankings** are there for a set of 3 constraints?
  - Constraints: **A B C**

### 3. Factorial typology

- How many **possible rankings** are there for a set of 3 constraints?



- $3 * 2 * 1 = 6$  rankings ('3 factorial')
- $n * (n-1) * (n-2) * \dots * 1 = n!$  ('n factorial')
- The **set of all possible rankings** of a set of constraints is called the '**factorial typology**' of that set of constraints

## 4. Factorial typology of basic syllable structure

- Exercise: Constraint rankings and their predictions
  - What are **all the rankings** of the mini constraint set NoEPENTHESIS, ONSET, NoCODA?

## 4. Factorial typology of basic syllable structure

- **All the rankings** of NoEPENTHESIS, ONSET, NoCODA?

1	ONSET	»	NoCODA	»	NoEPENTHESIS
2	NoCODA	»	ONSET	»	NoEPENTHESIS
3	NoEPENTHESIS	»	ONSET	»	NoCODA
4	NoEPENTHESIS	»	NoCODA	»	ONSET
5	ONSET	»	NoEPENTHESIS	»	NoCODA
6	NoCODA	»	NoEPENTHESIS	»	ONSET

**Group discussion** | For your ranking:

- Which **output** wins for **/abik/**? **/kamo/**?
- Which  **$\sigma$  types** (CV, CVC, V, CV) are **allowed**?

## 4. Factorial typology of basic syllable structure

### Debriefing

Questions for us to consider:

- **Which output** wins for **/abik/** under each ranking?  
What about **/kamo/**?
  - What “kind of language” does each ranking produce? (generalizations about  $\sigma$  structure)
- Are all the **predicted language types** plausible?
  - What are the actual cross-linguistic facts about onsets and codas?

## 4. Factorial typology of basic syllable structure

- What violations are assigned to each of these candidates? (dashed lines = constraints not ranked)

- Do different rankings predict different winners?

/abik/	NoEPENTH	ONSET	NoCODA
(a) a.bik			
(b) a.bi.kə			
(c) ta.bik			
(d) ta.bi.kə			

## 4. Factorial typology of basic syllable structure

- What violations are assigned to each of these candidates? (dashed lines = constraints not ranked)
  - Do different rankings predict different winners?

/abik/	NoEPENTH	ONSET	NoCODA
(a) a.bik		*	*
(b) a.bi.kə	*	*	
(c) ta.bik	*		*
(d) ta.bi.kə	**		

## 4. Factorial typology of basic syllable structure

- What violations are assigned to each of these candidates? (dashed lines = constraints not ranked)

- Do different rankings predict different winners?

/kamo/	NoEPENTH	ONSET	NoCODA
(a) ka.mo			
(b) kam.o			
(c) ə.ka.mo			
(d) ka.mot			

## 4. Factorial typology of basic syllable structure

- What violations are assigned to each of these candidates? (dashed lines = constraints not ranked)
  - Do different rankings predict different winners?

/kamo/	NoEPENTH	ONSET	NoCODA
(a) ka.mo			
(b) kam.o		*	*
(c) ə.ka.mo	*	*	
(d) ka.mot	*		*

## 4. Factorial typology of basic syllable structure

- Which output wins for /abik/ under this ranking?

### 1) ONSET » NoCODA » NoEPENTHESIS

/abik/	ONSET	NoCODA	NoEPENTH
(a) a.bik	*	*	
(b) a.bi.kə	*		*
(c) ta.bik		*	*
(d) ta.bi.kə			**

## 4. Factorial typology of basic syllable structure

- Which output wins for /abik/ under this ranking?

1)  $O_{\text{NSET}} \gg \text{NoCODA} \gg \text{NoEPENTHESIS}$       /abik/ → [ta.bi.kə]

/abik/	$O_{\text{NSET}}$	NoCODA	NoEPENTH
(a) a.bik	*!	*	
(b) a.bi.kə	*!		*
(c) ta.bik		*!	*
→ (d) ta.bi.kə			**

## 4. Factorial typology of basic syllable structure

- Which output wins for /abik/ under this ranking?

2) NoCODA » ONSET » NoEPENTHESIS

/abik/	NoCODA	ONSET	NoEPENTH
(a) a.bik	*	*	
(b) a.bi.kə		*	*
(c) ta.bik	*		*
(d) ta.bi.kə			**

## 4. Factorial typology of basic syllable structure

- Which output wins for /abik/ under this ranking?

2) NoCODA » ONSET » NoEPENTHESIS

/abik/ → [ta.bi.kə]

/abik/	NoCODA	ONSET	NoEPENTH
(a) a.bik	*!	*	
(b) a.bi.kə		*!	*
(c) ta.bik	*!		*
→ (d) ta.bi.kə			**

## 4. Factorial typology of basic syllable structure

- Which output wins for /abik/ under this ranking?

### 3) NoEPENTHESIS » ONSET » NoCODA

/abik/	NoEPENTH	ONSET	NoCODA
(a) a.bik		*	*
(b) a.bi.kə	*	*	
(c) ta.bik	*		*
(d) ta.bi.kə	**		

## 4. Factorial typology of basic syllable structure

- Which output wins for /abik/ under this ranking?

3) NoEPENTHESIS » ONSET » NoCODA

/abik/ → [a.bik]

/abik/	NoEPENTH	ONSET	NoCODA
→ (a) a.bik		*	*
(b) a.bi.kə	*!	*	
(c) ta.bik	*!		*
(d) ta.bi.kə	*!*		

## 4. Factorial typology of basic syllable structure

- Which output wins for /abik/ under this ranking?

### 4) NoEPENTHESIS » NoCODA » ONSET

/abik/	NoEPENTH	NoCODA	ONSET
(a) a.bik		*	*
(b) a.bi.kə	*		*
(c) ta.bik	*	*	
(d) ta.bi.kə	**		

# 4. Factorial typology of basic syllable structure

- Which output wins for /abik/ under this ranking?

4) NoEPENTHESIS » NoCODA » ONSET      /abik/ → [a.bik]

/abik/	NoEPENTH	NoCODA	ONSET
→ (a) a.bik		*	*
(b) a.bi.kə	*!		*
(c) ta.bik	*!	*	
(d) ta.bi.kə	*!*		

## 4. Factorial typology of basic syllable structure

- Which output wins for /abik/ under this ranking?

### 5) ONSET » NOEPENTHESIS » NOCODA

/abik/	ONSET	NOEPENTH	NOCODA
(a) a.bik	*		*
(b) a.bi.kə	*	*	
(c) ta.bik		*	*
(d) ta.bi.kə		**	

## 4. Factorial typology of basic syllable structure

- Which output wins for /abik/ under this ranking?

5)  $O_{\text{NSET}} \gg \text{NoE}_{\text{PENTHESIS}} \gg \text{NoC}_{\text{ODA}}$      /abik/ → [ta.bik]

/abik/	$O_{\text{NSET}}$	$\text{NoE}_{\text{PENTH}}$	$\text{NoC}_{\text{ODA}}$
(a) a.bik	*!		*
(b) a.bi.kə	*!	*	
→ (c) ta.bik		*	*
(d) ta.bi.kə		**!	

## 4. Factorial typology of basic syllable structure

- Which output wins for /abik/ under this ranking?

6) NoCODA » NoEPENTHESIS » ONSET

/abik/	NoCODA	NoEPENTH	ONSET
(a) a.bik	*		*
(b) a.bi.kə		*	*
(c) ta.bik	*	*	
(d) ta.bi.kə		**	

## 4. Factorial typology of basic syllable structure

- Which output wins for /abik/ under this ranking?

6) NoCODA » NoEPENTHESIS » ONSET      /abik/ → [a.bi.kə]

/abik/	NoCODA	NoEPENTH	ONSET
(a) a.bik	*!		*
→ (b) a.bi.kə		*	*
(c) ta.bik	*!	*	
(d) ta.bi.kə		**!	

## 4. Factorial typology of basic syllable structure

- Which output wins for /abik/ under each ranking?

1 ONSET » NoCODA » NoEPENTH      /abik/ → [ta.bi.kə]

2 NoCODA » ONSET » NoEPENTH      /abik/ → [ta.bi.kə]

3 NoEPENTH » ONSET » NoCODA      /abik/ → [a.bik]

4 NoEPENTH » NoCODA » ONSET      /abik/ → [a.bik]

5 ONSET » NoEPENTH » NoCODA      /abik/ → [ta.bik]

6 NoCODA » NoEPENTH » ONSET      /abik/ → [a.bi.kə]

## 4. Factorial typology of basic syllable structure

- Which output wins for /abik/ under these rankings?

1    ONSET » NoCODA » NoEPENTH      /abik/ → [ta.bi.kə]

2    NoCODA » ONSET » NoEPENTH      /abik/ → [ta.bi.kə]

- What generalizations can we make about syllable structure options for a language with this pattern?

## 4. Factorial typology of basic syllable structure

- Which output wins for /abik/ under these rankings?

1    ONSET » NoCODA » NoEPENTH      /abik/ → [ta.bi.kə]

2    NoCODA » ONSET » NoEPENTH      /abik/ → [ta.bi.kə]

- What generalizations can we make about syllable structure options for a language with this pattern?
  - Onsetless syllables are forbidden
  - Codas are forbidden

## 4. Factorial typology of basic syllable structure

- Which output wins for /abik/ under these rankings?

3 NoEPENTH » ONSET » NoCODA     /abik/ → [a.bik]

4 NoEPENTH » NoCODA » ONSET     /abik/ → [a.bik]

- What generalizations can we make about syllable structure options for a language with this pattern?

## 4. Factorial typology of basic syllable structure

- Which output wins for /abik/ under these rankings?

3 NoEPENTH » ONSET » NoCODA     /abik/ → [a.bik]

4 NoEPENTH » NoCODA » ONSET     /abik/ → [a.bik]

- What generalizations can we make about syllable structure options for a language with this pattern?
  - Onsetless syllables are allowed
  - Codas are allowed

## 4. Factorial typology of basic syllable structure

- Which output wins for /abik/ under this ranking?

5 ONSET » NOEPENTH » NOCODA     /abik/ → [ta.bik]

- What generalizations can we make about syllable structure options for a language with this pattern?

## 4. Factorial typology of basic syllable structure

- Which output wins for /abik/ under this ranking?

5 ONSET » NoEPENTH » NoCODA     /abik/ → [ta.bik]

- What generalizations can we make about syllable structure options for a language with this pattern?
  - Onsetless syllables are forbidden
  - Codas are allowed

## 4. Factorial typology of basic syllable structure

- Which output wins for /abik/ under each ranking?

6 NoCODA » NoEPENTH » ONSET      /abik/ → [a.bi.kə]

- What generalizations can we make about syllable structure options for a language with this pattern?

## 4. Factorial typology of basic syllable structure

- Which output wins for /abik/ under each ranking?

6 NoCODA » NoEPENTH » ONSET     /abik/ → [a.bi.kə]

- What generalizations can we make about syllable structure options for a language with this pattern?
  - Onsetless syllables are allowed
  - Codas are forbidden



## 4. Factorial typology of basic syllable structure

- Are the predictions of our constraint set plausible?

<i>Ranking</i>	<i>Onsets?</i>	<i>Codas?</i>
1 $\text{ONSET} \gg \text{NoCODA} \gg \text{NoEP}$ 2 $\text{NoCODA} \gg \text{ONSET} \gg \text{NoEP}$	required	forbidden
3 $\text{NoEP} \gg \text{ONSET} \gg \text{NoCODA}$ 4 $\text{NoEP} \gg \text{NoCODA} \gg \text{ONSET}$	not required	not forbidden
5 $\text{ONSET} \gg \text{NoEP} \gg \text{NoCODA}$	required	not forbidden
6 $\text{NoCODA} \gg \text{NoEP} \gg \text{ONSET}$	not required	forbidden

## 4. Factorial typology of basic syllable structure

- Are the predictions of our constraint set plausible?

<i>Ranking</i>	<i>Onsets?</i>	<i>Codas?</i>
1 ONSET » NoCODA » NoEP 2 NoCODA » ONSET » NoEP	required	forbidden
3 NoEP » ONSET » NoCODA 4 NoEP » NoCODA » ONSET	not required	not forbidden
5 ONSET » NoEP » NoCODA	required	not forbidden
6 NoCODA » NoEP » ONSET	not required	forbidden

- Yes! Onsets can be required; codas can be banned; no language *bans* onsets, *requires* codas

## 4. Factorial typology of basic syllable structure

- Are the predictions of our constraint set plausible?
  - Yes! Onsets can be required; codas can be banned; no language *bans* onsets, *requires* codas
- Of course, we have to take into account NoDELETION as well — some languages that enforce onsets or ban codas do so via deletion instead of epenthesis
  - Checking that by hand would require that we look at  $4! = 24$  grammars, not just 6

## 5. Factorial typology—conclusions, implications

- Ways to do an **approximate** check on the factorial-typology predictions of a **larger** constraint set
  - Consider what would happen *if each constraint were the highest ranked*
    - Example: If we propose a “HAVECODA” constraint, it will make bad predictions
  - Consider what would happen we switch the rankings of *just the faithfulness constraints* or *just the markedness constraints*
    - Example: Our 6 grammars, but with NoDELETION *ranked below* NoEPENTHESIS

## 5. Factorial typology—conclusions, implications

- One more complication
  - Sometimes there is a ranking predicted by factorial typology that no **known** language **actually uses**
  - This can often be explained by factors related to **phonetics, child language acquisition, and historical change**
    - A ranking that children would never see evidence to learn (for phonetic reasons) would never arise in any language

## 5. Factorial typology—conclusions, implications

- A key point of this discussion
  - **Every OT analysis** is also inherently **making typological predictions**
  - This makes the theory more interesting, and **places more restrictions on it**, compared to rule-based phonology