

# What can Match Theory tell us about the prosody of adverbial clauses?

**Emily Elfner**

York University

eelfner@yorku.ca

# Introduction

- This talk explores how recent advancements in the syntax/semantics/pragmatics of adverbial clauses may be analyzed using **Match Theory** (Selkirk 2011).
- **Match Theory** is a model of the syntax-prosody interface that assumes a close integration between syntactic and prosodic structure, while also allowing for the influence of purely phonological/prosodic constraints.

# Introduction

- **Adverbial clauses** are an interesting test case because they show both **syntactic differences** (i.e. in terms of attachment height), as well as variation in terms of **prosodic structure** (i.e. whether or not they are prosodically integrated with the main clause).
- Recent research suggests that there is **more prosodic variation** than previously thought, although many empirical questions remain.

# Introduction

- I will explore various predictions and possibilities within the **Match Theory** framework, including the **role of recursion** in prosodic structure.
- I will also discuss the more recent proposal that the interface between syntactic and prosodic structure is indirect, i.e. the **MSO-PI-PO model** (Kratzer & Selkirk 2020, Lee & Selkirk 2022), and how this may relate to the prosody of adverbial clauses.

# ADVERBIAL CLAUSES AND PROSODY

# Adverbial clauses and prosodic integration

- Adverbial clauses in languages such as English show a correlation between **syntactic attachment** and **prosodic integration** with the main clause.
- In general:
  - Adverbial clauses with **low syntactic attachment** (e.g. adjunct to VP) tend to be prosodically integrated with the main clause
  - Adverbial clauses with **high syntactic attachment** (e.g. adjunct to CP) tend to be prosodically independent from the main clause

# Adverbial clauses and prosodic integration

- For example: *because* clause (Selkirk 2005):
  - a.  $\downarrow$ ( $\varphi$ (Cindy isn't planting a garden)  $\varphi$ (because she loves tomatoes))  
... *rather, she is planting a garden because she loves flowers.*
  - b.  $\downarrow$ ( $\varphi$ (Cindy isn't planting a garden))  $\downarrow$ ( $\varphi$ (because she loves tomatoes))  
... *she knows that it isn't going to be a good year to grow tomatoes.*
- These two types of adverbial clauses also differ in terms of **syntactic/semantic interpretation.**

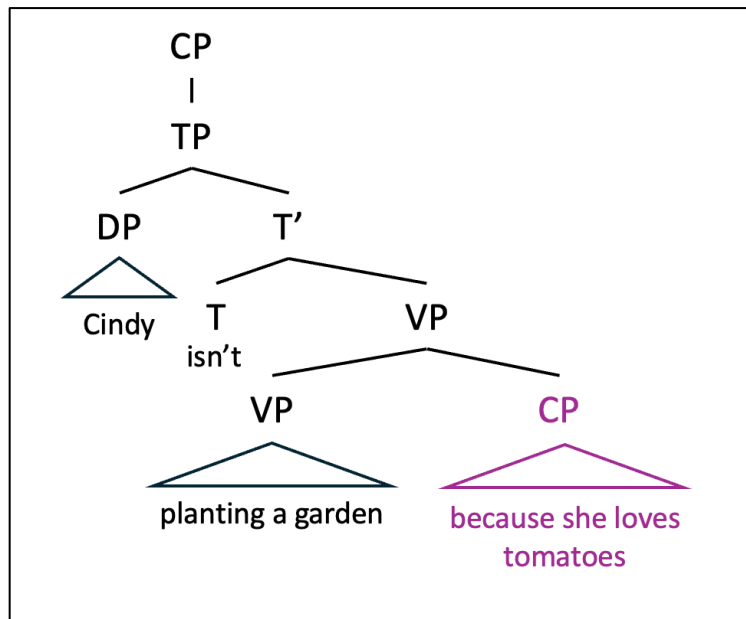
# Adverbial clauses and prosodic integration

- Structurally, the contrast between these two types of adverbial clauses has been attributed to the **syntactic attachment site** of the adverbial clause.
- Specifically:
  - **Type (a)** (prosodically integrated): the adverbial clause is attached **low**, e.g. as a VP adjunct
  - **Type (b)** (not prosodically integrated): the adverbial clause is attached **high**, e.g. as a CP adjunct

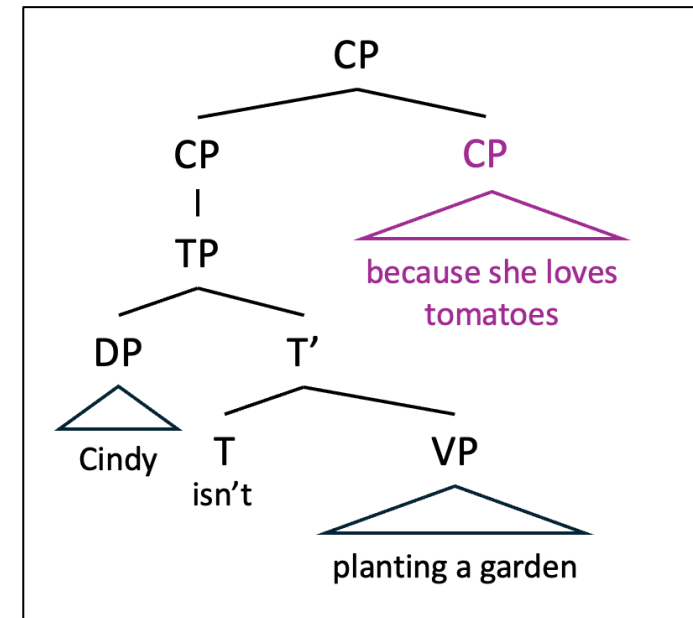
# Adverbial clauses and prosodic integration

- We can see this in the following tree structures:

**Type (a): low attachment**



**Type (b): high attachment**



# Adverbial clauses and prosodic integration

- Similar patterns can be observed for a variety of post-clausal adverbial clauses in English and other languages.
- Haegeman (2003) proposed a distinction between **central** and **peripheral adverbial clauses**:
  - **Type (a)** = central adverbial clauses (integrated)
  - **Type (b)** = peripheral adverbial clauses (independent)
- In recent years this classification has been revised, but we will start here.

# MATCH THEORY

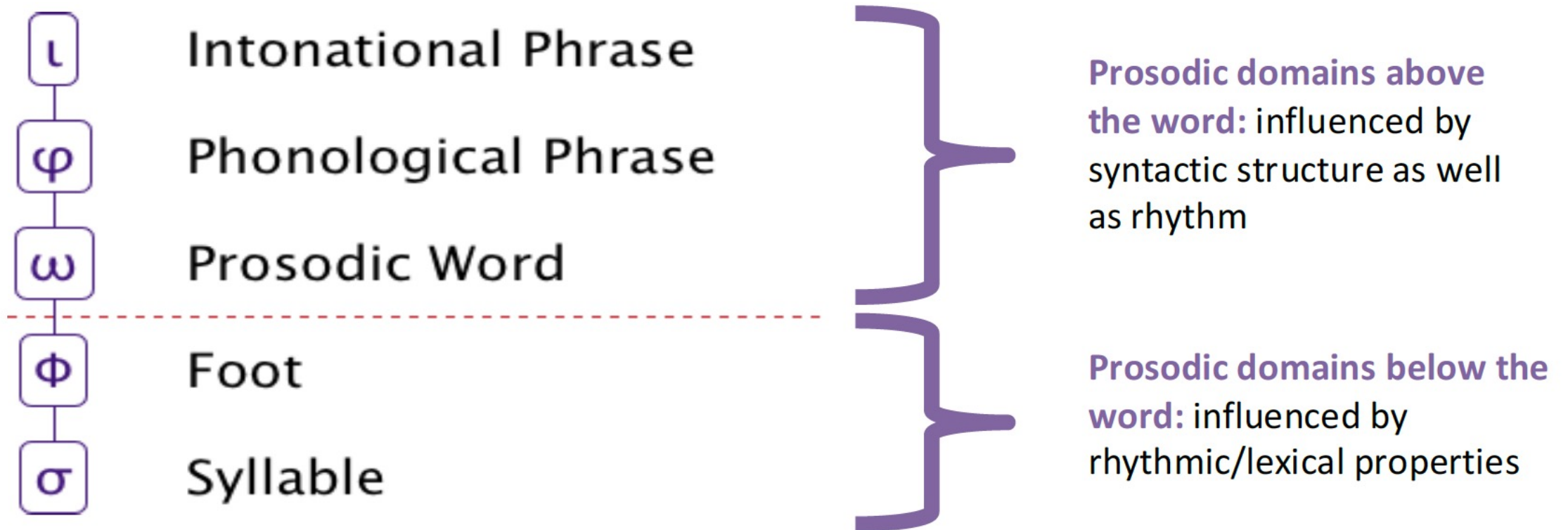
# Match Theory

- **Match Theory** (Selkirk 2011) is a theory of syntax-prosody mapping.
- In its original formulation, Match Theory proposes a close correspondence between **syntactic constituents** of certain types and **prosodic constituents** of certain types.

# Match Theory

- Match Theory is couched within **Prosodic Hierarchy Theory** (Selkirk 1978 et seq., Nespor & Vogel 1986, Pierrehumbert & Beckman 1988).
- **Prosodic Hierarchy Theory** asserts that phonological structure is:
  - Hierarchically structured (like syntax)
  - Constrained by a universal set of prosodic categories of differing sizes (distinct from syntactic categories)
  - Informed by syntactic structure, but is not identical to it

# The Prosodic Hierarchy



# Match Theory

- Match Theory predicts that:
  - Syntactic constituents correspond to prosodic constituents via a family of correspondence constraints called **MATCH constraints**
  - Prosodic structure is **inherently recursive** because syntactic structure is hierarchically structured
  - Assumes traditional (minimal) prosodic hierarchy above  $\omega$  (Selkirk 1978 et seq., Nespor & Vogel 1986): **Intonational Phrase ( $\iota$ )**, **Phonological Phrase ( $\varphi$ )**, and **Prosodic Word ( $\omega$ )**

# Match Theory

- Specifically, Match Theory proposes that above- $\omega$  prosodic categories are **grounded** in syntactic constituent structure (Selkirk 2011)

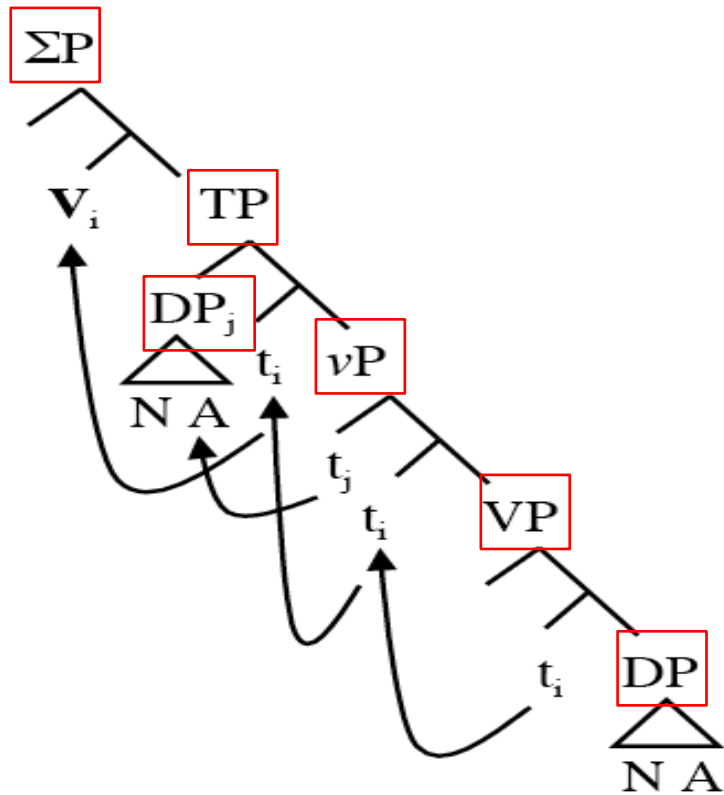
MATCH-CLAUSE: syntactic clause  $\rightarrow$  intonational phrase ( $\iota$ )

MATCH-PHRASE: syntactic phrase (XP)  $\rightarrow$  phonological phrase ( $\varphi$ )

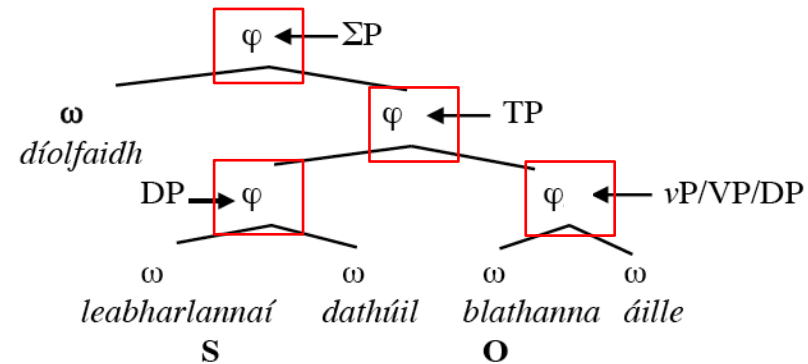
MATCH-WORD: syntactic word  $\rightarrow$  prosodic word ( $\omega$ )

# Example: Irish (Elfner 2012, 2015)

## Syntactic representation



## Recursive prosodic structure (MATCH-PHRASE)



# Match Theory

- On their own, MATCH constraints predict a **one-to-one correspondence** between syntactic and prosodic constituent structure.
- When **mismatches** between syntactic and prosodic structure do occur, these are assumed to be from the influence of purely **prosodic well-formedness (markedness) constraints**.
- Assuming an **Optimality-Theoretic framework** (Prince & Smolensky 1993/2004), language-specific **ranking of constraints** will determine how closely syntactic and prosodic constituent structure align.

# Adverbial clauses

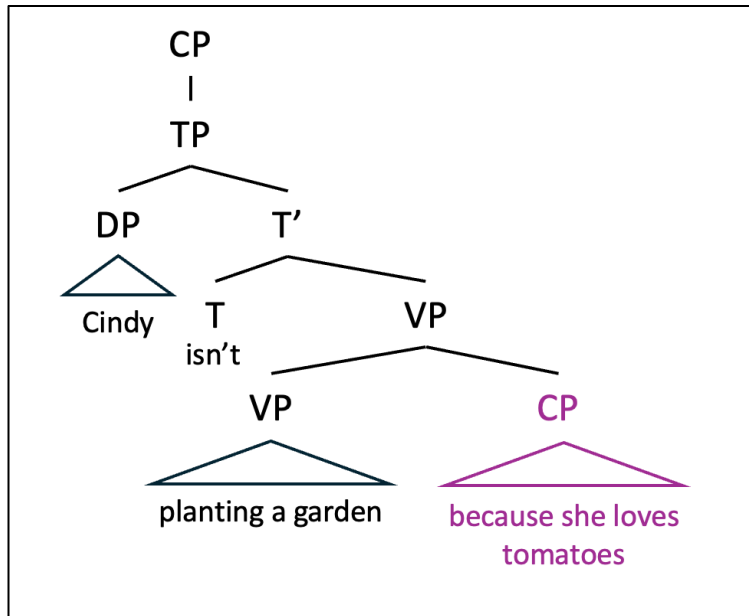
- Returning to **adverbial clauses**, we can see that Match Theory should be able to account for the prosodic difference between the **Type (a)** and **Type (b)** adverbial clauses, provided that there is a **structural** difference.
- Since this distinction can be captured using low/high attaching adjuncts in the syntactic structure, this can be translated into **recursive prosodic structure** using MATCH constraints.

# Adverbial clauses

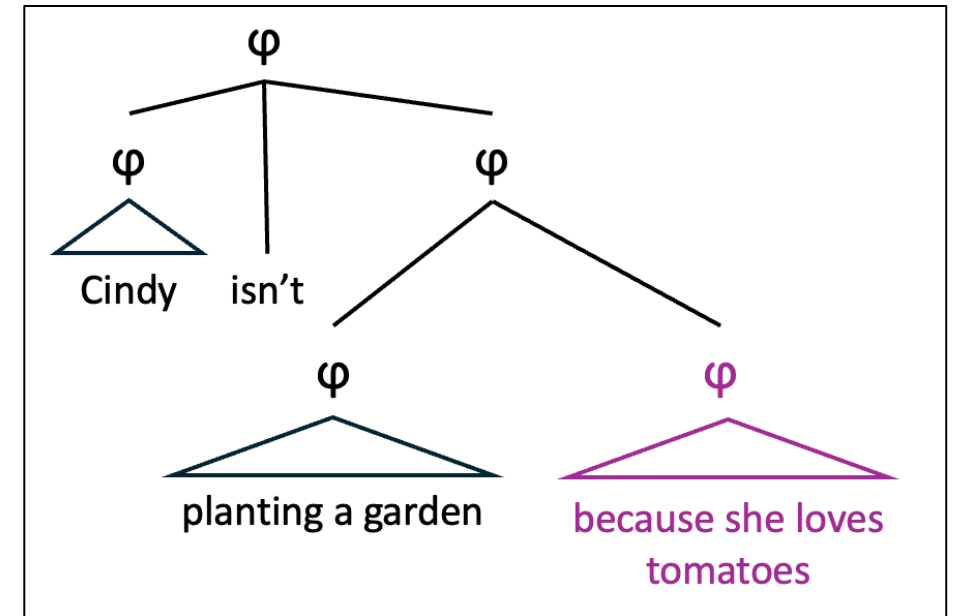
- If we ignore the distinction between  $\varphi$  and  $\iota$  for now, MATCH-PHRASE will produce mappings like the following.

# Adverbial clauses

## Type (a): low attachment (TP-internal VP adjunct)

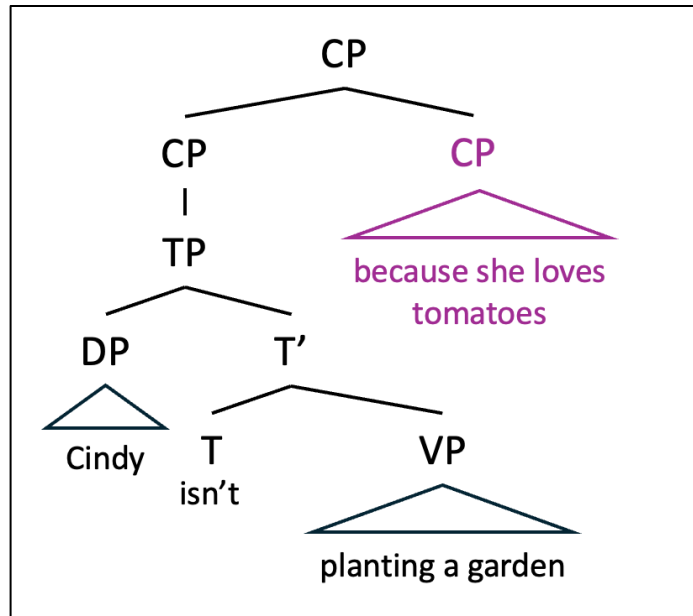


**MATCH-PHRASE**

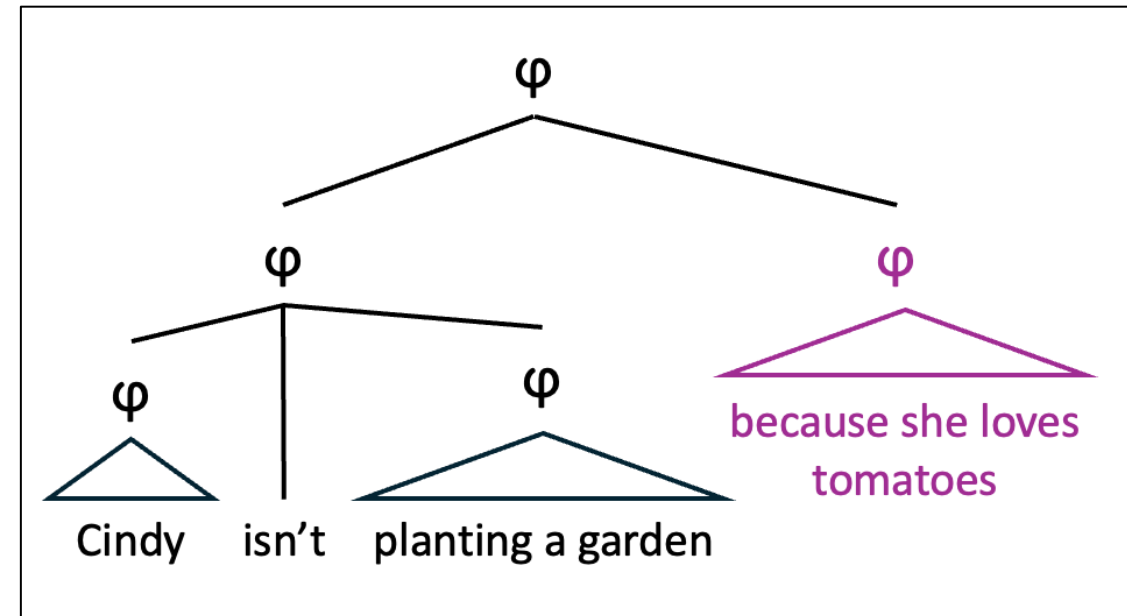


# Adverbial clauses

## Type (b): high attachment (TP external/CP adjunct)



**MATCH-PHRASE**



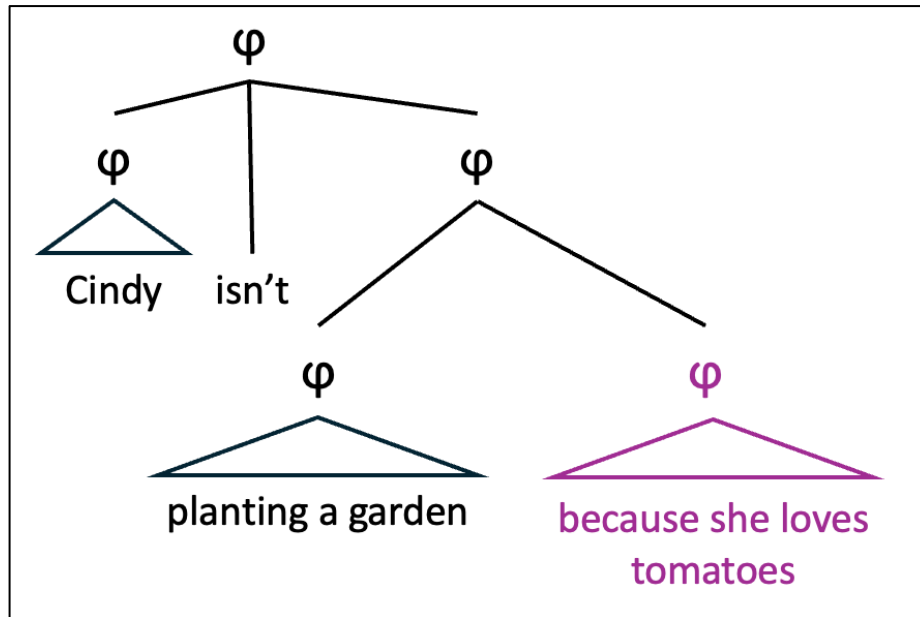
# Adverbial clauses

- Side-by-side, the **prosodic** difference between the two structures is that:
  - In Type (a), the VP and the adverbial clause are contained within the same prosodic phrase ( $\varphi$ )
  - In Type (b), the matrix clause as a whole and the adverbial clause are contained within the same prosodic phrase ( $\varphi$ )

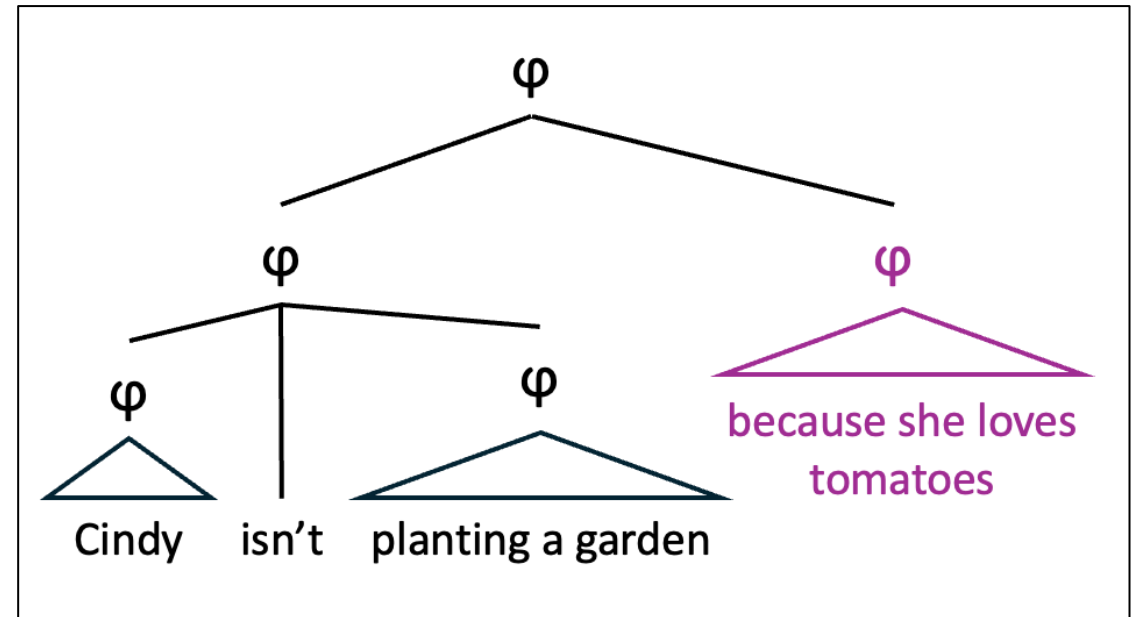
# Adverbial clauses

- We can see this in the following tree structures:

**Type (a): low attachment**



**Type (b): high attachment**



# Adverbial clauses

- The two types of adverbial clauses thus are predicted to have **distinct prosodic structures**, as derived from their **distinct syntactic structures**.
- However, what results in their distinct **phonology**? How can we account for differences in **boundary strength** and categorical phenomena like the presence of **boundary tones**?

# Adverbial clauses

- Selkirk (2005) notes three types of prosodic cues distinguish the **stronger juncture** between the matrix clause and the adverbial clause in the **Type (b)** cases :
  1. The “comma-pause” disjuncture (i.e. a pause between constituents)
  2. The availability of a final L-H% (boundary tone) on the last word of the matrix clause (“continuation rise” or “comma intonation”)
  3. Significant upward pitch reset on *because*

# Adverbial clauses

- These observations can be schematized in the following way:

a.  $\varphi$ (Cindy isn't  $\varphi$ (  $\varphi$ ( planting a garden)  $\varphi$ (because she loves tomatoes)))

no pitch reset  
L-  
no disjuncture possible

---

b.  $\varphi$ (  $\varphi$ (Cindy isn't planting a garden)  $\varphi$ (because she loves tomatoes))

L-H%  
pitch reset  
disjuncture possible

# INTONATIONAL PHRASES

# Intonational Phrases

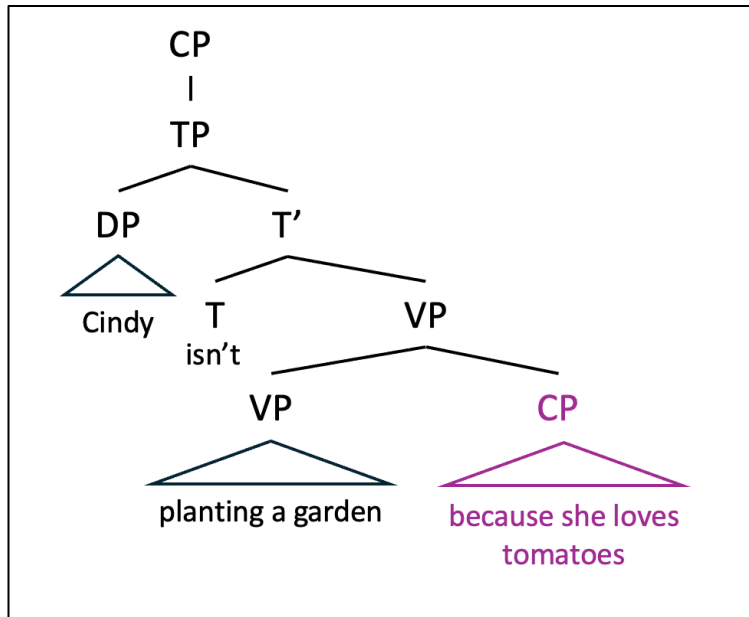
- **Intonational Phrases** ( $\iota$  or IP) are the highest level in the assumed Prosodic Hierarchy.
- Match Theory proposes a **MATCH-CLAUSE** constraint mapping **syntactic clauses** onto **intonational phrases** ( $\iota$ ).
- Taken at face value, we could interpret this as a prediction that **any CP** in the syntactic structure should map onto an  $\iota$  in the prosodic structure.

# Intonational Phrase

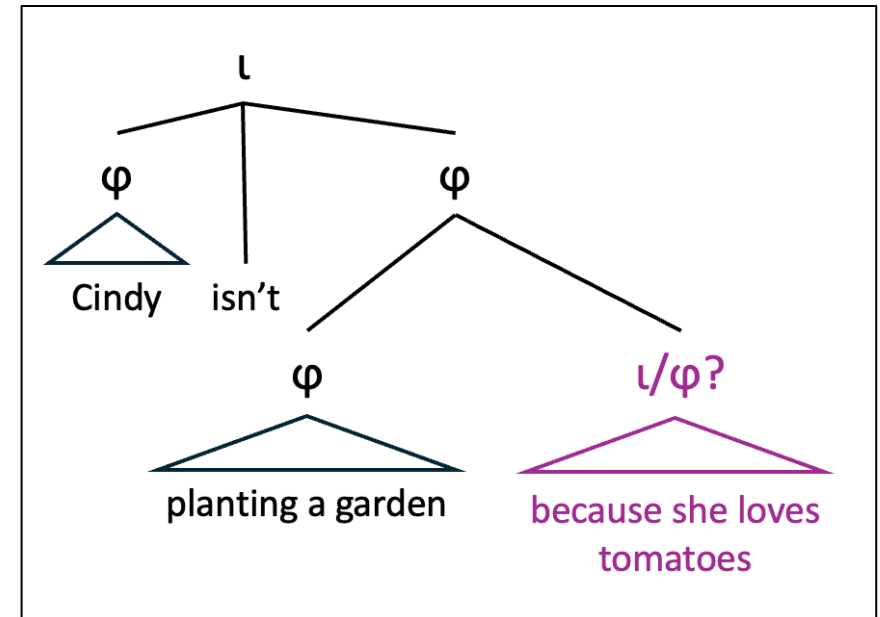
- Assuming the constraint **MATCH-CLAUSE** would in effect encode a distinction at the relevant location in each structure.
  - In Type (a): Low attachment, the adverbial clause adjoins **within** the matrix CP (i.e. within same  $\iota$ )
  - In Type (b): High attachment, the adverbial clause adjoins **outside** the matrix CP (i.e. in separate  $\iota$ )
- Prosodically: the phonetic **cues** to  $\iota$  occur at the **right** edge of  $\iota$  (Selkirk 2005)

# Intonational Phrases

## Type (a): low attachment (TP-internal VP adjunct)

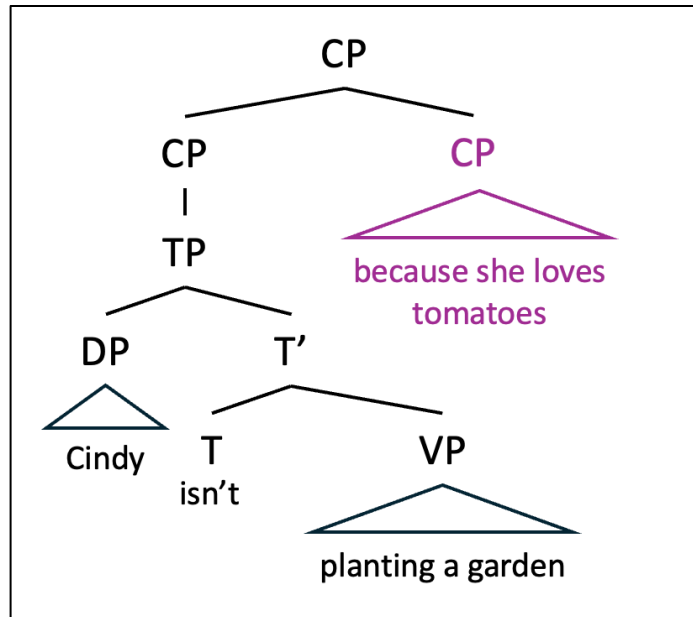


**MATCH-CLAUSE  
MATCH-PHRASE**



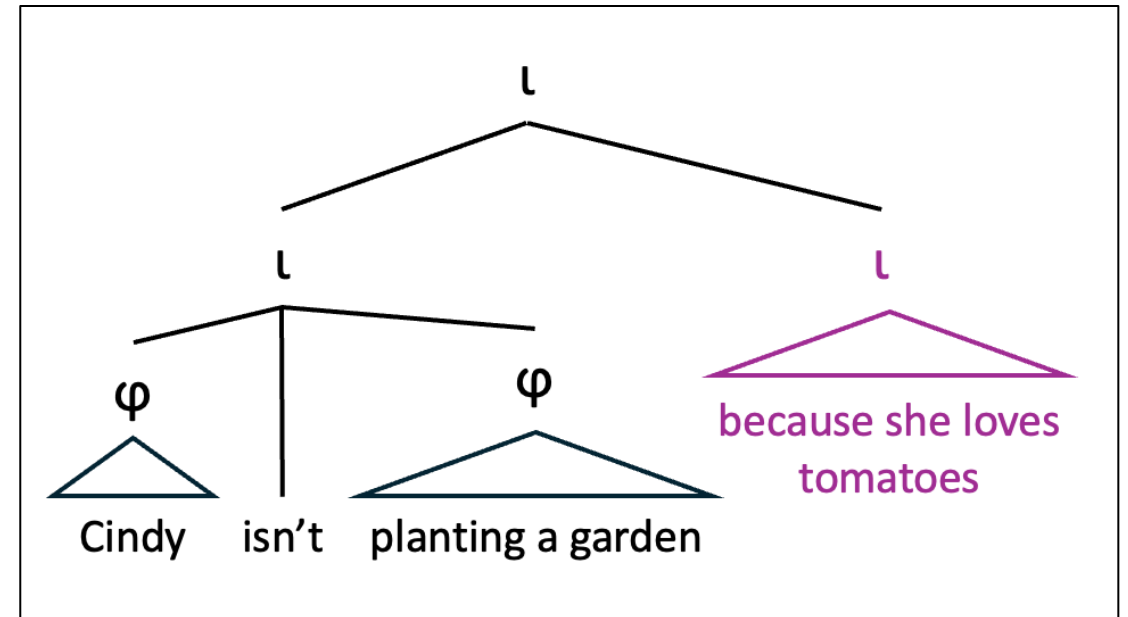
# Intonational Phrases

## Type (b): high attachment (TP external/CP adjunct)



**MATCH-CLAUSE  
MATCH-PHRASE**

→

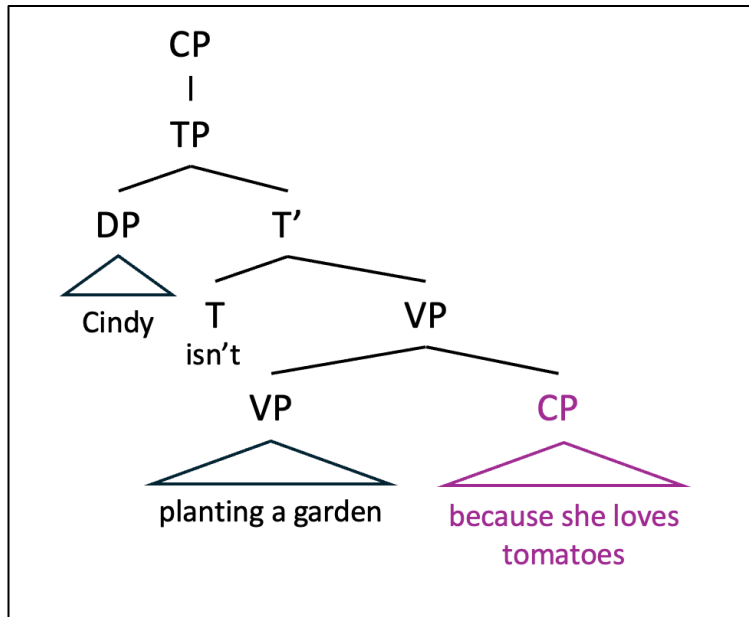


# Intonational Phrases

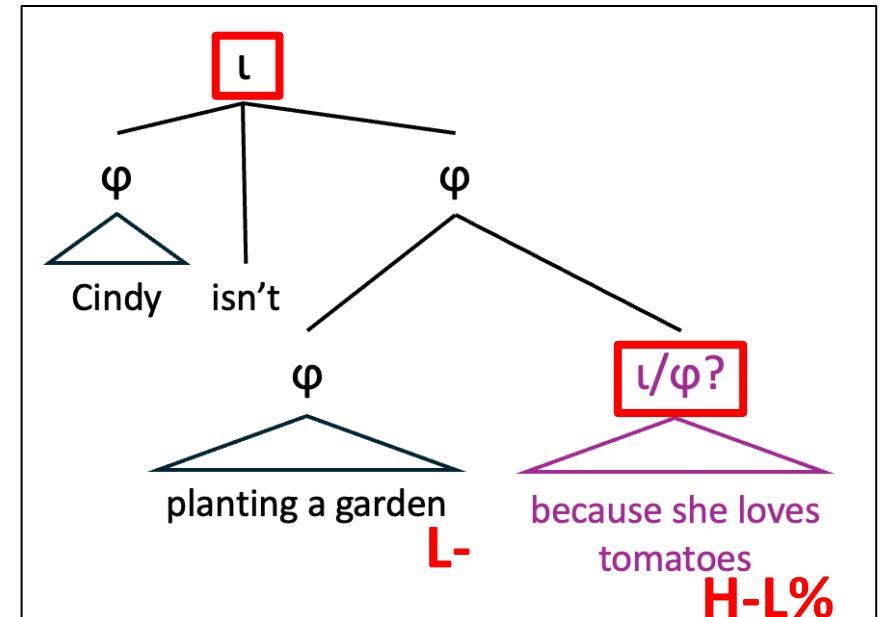
- In Match Theory, the structural representation is determined by the **syntax**, while the phonological cues to prosodic structure are provided by **phonological constraints** and **phonetic interpretation**.
- Thus, we can assume that English has phonetic/phonological constraints that do the following at the right edge of  $\iota$ :
  - Inserts an optional “comma-pause” disjuncture
  - Inserts an L-H%
  - Initiates pitch reset following an  $\iota$  boundary

# Intonational Phrases

## Type (a): low attachment (TP-internal VP adjunct)

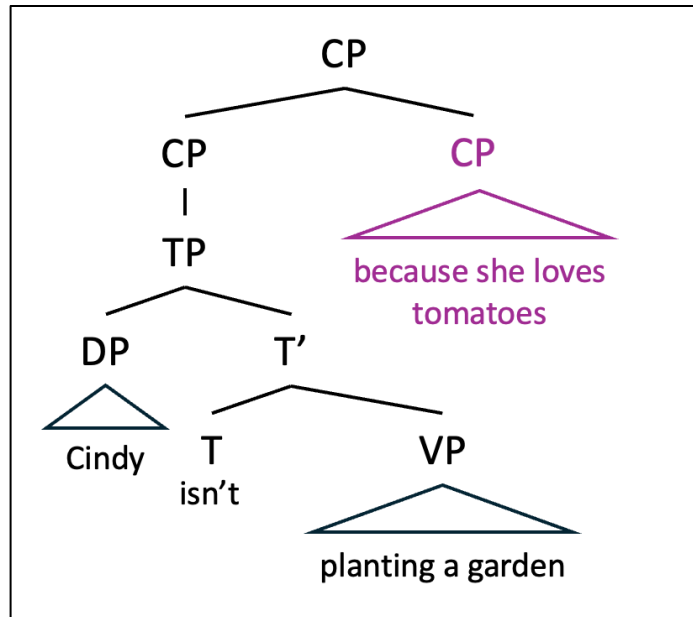


MATCH-CLAUSE  
MATCH-PHRASE



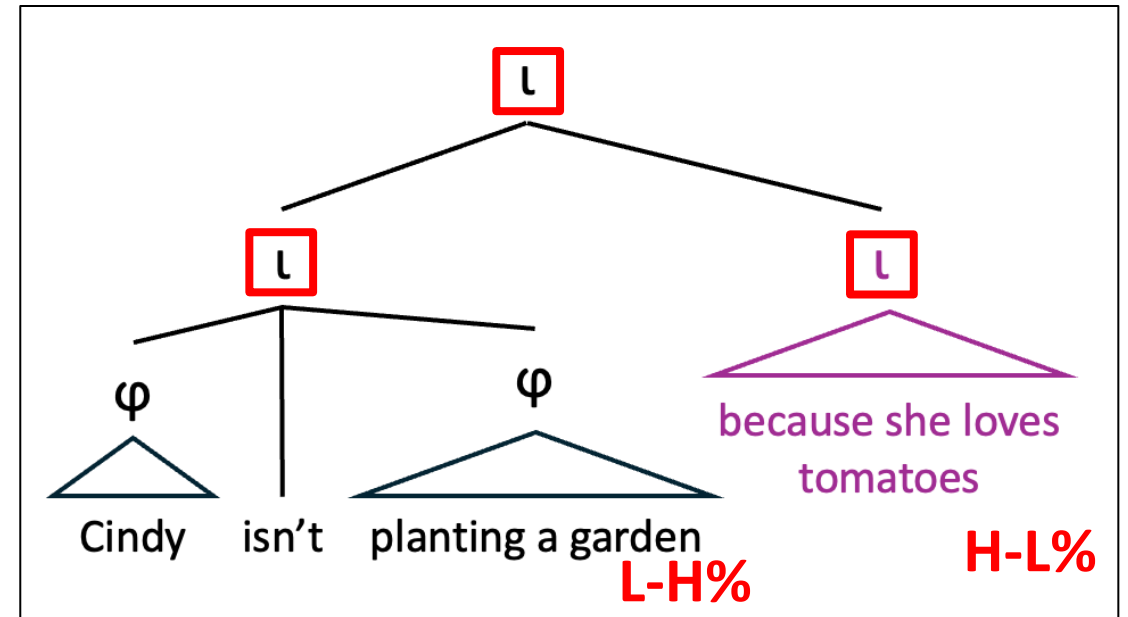
# Intonational Phrases

## Type (b): high attachment (TP external/CP adjunct)



**MATCH-CLAUSE  
MATCH-PHRASE**

→



# MATCH CLAUSE

# MATCH-CLAUSE

- However, it is by no means clear that the “syntactic clause” referred to by MATCH-CLAUSE should refer to a CP.
- Selkirk (2011) considers two options:
  - $\iota$  as **CP** (or **complement of CP**)
  - $\iota$  as **ForceP** (= speech act, similar to CommaP)
- Hamlaoui & Szendrői (2015, 2017) propose the Flexible Approach:
  - $\iota$  as the **highest projection occupied by the root verb**

# MATCH-CLAUSE

- Setting syntactic proposals aside, the proposal that speech acts (through e.g. ForceP) play a role in determining  $\iota$  status relies on an integration of **discourse** and **narrow syntax**.
- Namely, that there is a syntactic projection, ForceP, that encodes speech acts.
- It is this projection that distinguishes between what gets mapped to  $\varphi$  (i.e. any other XP) vs. mapped to  $\iota$ .

# MATCH-CLAUSE

- Returning to adverbial clauses...
- As discussed in Frey (2016, 2020), Haegeman et al. (2026): not all **peripheral adverbial clauses** seem to operate within the narrow syntax.
- Specifically, expansion to distinguish **three types** of adverbial clauses:
  1. **Central adverbial clauses (CAC)**: modify the matrix event: low attachment within TP.
  2. **Peripheral adverbial clauses (PAC)**: modify the matrix preposition: high attachment within TP.
  3. **Non-integrated adverbial clauses (NonIC)**: modify the speech event: outside narrow syntax.

# MATCH-CLAUSE

- While the prosodic facts still remain a bit unclear, the revised proposal predicts that there is a distinction between high-attaching adverbial clauses that are integrated with the syntax vs. high-attaching adverbial clauses that are **not** integrated with the syntax.
- **NonICs** are predicted to be the most **prosodically separate** (and perhaps obligatorily so).

# MATCH-CLAUSE

- We have seen that the status of  $\iota$  in Match Theory (and beyond) remains unclear:
  - Match Theory is a theory based on a close mapping between syntactic and prosodic structure, yet the mapping of  $\iota$  (arguably) depends on a mapping between discourse and prosodic structure.
  - CPs are types of XPs, yet in Match Theory they (arguably) have special status. Why?

# MAXIMAL $\Phi$

# Maximal $\varphi$

- An alternative idea that can be explored within Match Theory regards the **separation** of the structural properties of  $\varphi$  and the discourse properties of  $\iota$ .
- Since Match Theory is a theory of mapping between syntactic and prosodic structure, perhaps a discourse-based version of MATCH-CLAUSE is not appropriate.
- Further, perhaps CP is really just a type of syntactic phrase (XP).

# Maximal $\varphi$

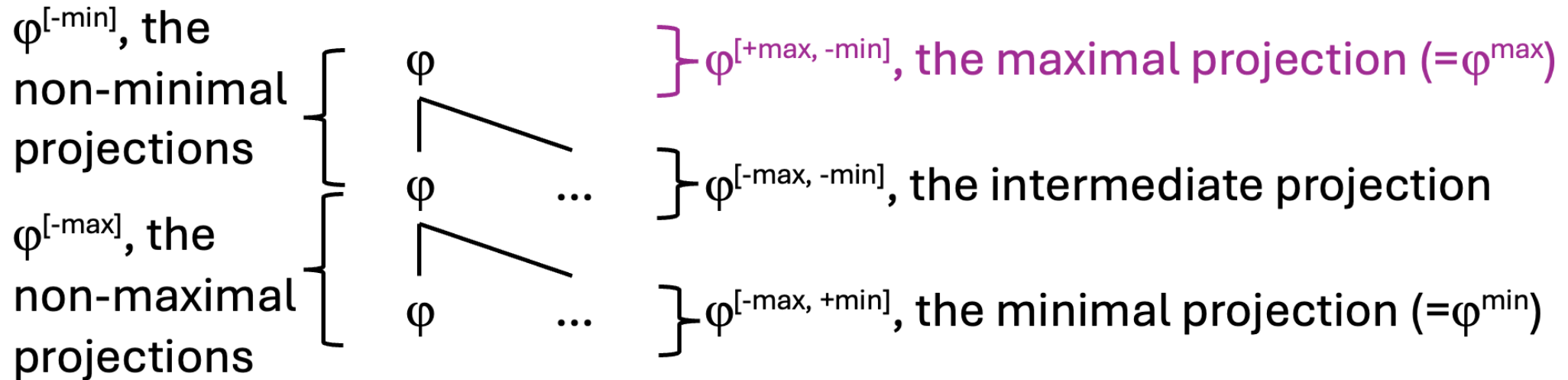
- The prosodic structure generated by the application of MATCH-PHRASE alone may be sufficient to account for the distinction between Type (a) (prosodically integrated) and Type (b) (prosodically non-integrated) adverbial clauses.
- Coupled with the idea that non-integrated adverbial clauses may not be generated (together) within the narrow syntax, it seems possible to account for the two prosodically distinct types of clauses.

# Maximal $\varphi$

- Ito & Mester (2013) propose that the presence of **recursion** in the prosodic structure generated by the application of MATCH constraints predicts that **phonological constraints** may be able to target the **recursive sub-categories** of recursive prosodic structures.

# Maximal $\varphi$

- For example (Ito & Mester 2013:23):



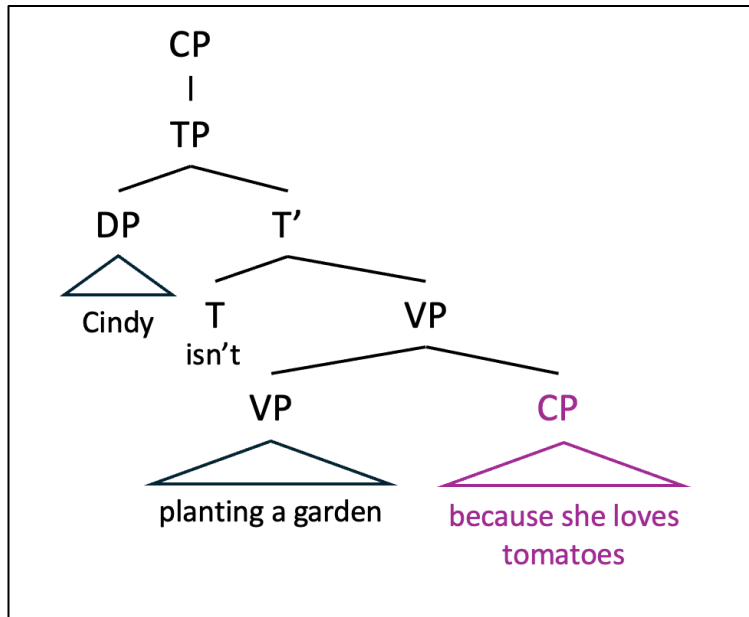
- In this representation,  $\varphi_{\text{Max}}$  is the maximal (top-most) projection of  $\varphi$  (akin to  $X^{\max}$  as the maximal projection of a syntactic phrase).

# Maximal $\varphi$

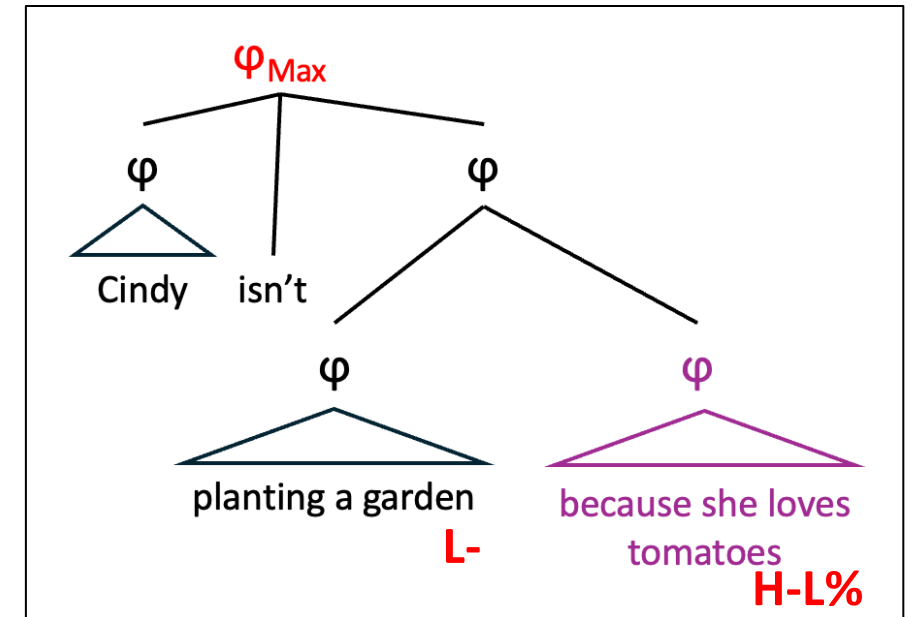
- Applying this logic, the topmost layer of any independent clause should equate to  $\varphi_{\text{Max}}$ .
- For example, for a Type (a) prosodically integrated (low-attaching) adverbial clause, this is predicted to map to a **single**  $\varphi_{\text{Max}}$  on the basis of MATCH-PHRASE alone.

# Maximal $\varphi$

## Type (a): low attachment (TP-internal VP adjunct)



**MATCH-PHRASE**



# Maximal $\varphi$

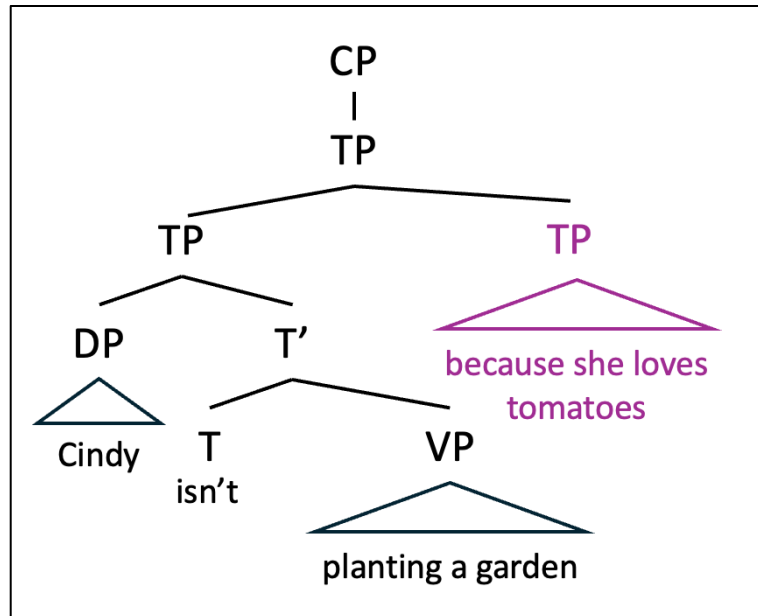
- If we assume that the properties of  $\iota$  phrases in English (as discussed previously) apply instead to the **right edge of  $\varphi_{\text{Max}}$** , we can derive the prosodic characteristics as well:
  - Inserts an optional “comma-pause” disjuncture
  - Inserts a boundary tone (such as L-H%)
  - Initiates pitch reset following an  $\iota$  boundary

# Maximal $\varphi$

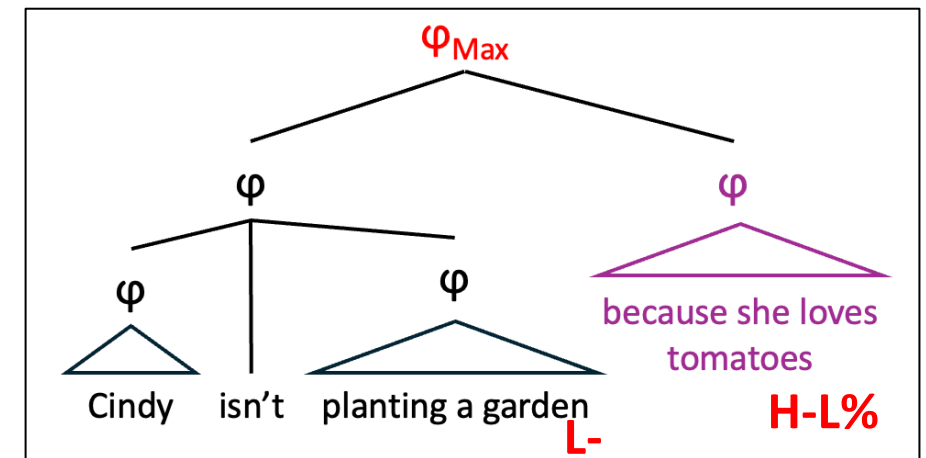
- This theory predicts that high-attaching adverbial clauses (e.g. TP adjuncts) should be **prosodically integrated** (i.e. within the same  $\varphi_{\text{Max}}$ ).
- However: note that the structures are still **distinct** in terms of the **depth of embedding**, which may correlate to relative **boundary strength** (e.g. Watson & Gibson 2004, Wagner 2015).

# Maximal $\varphi$

## Type (b): high attachment (TP-internal TP adjunct)



MATCH-PHRASE

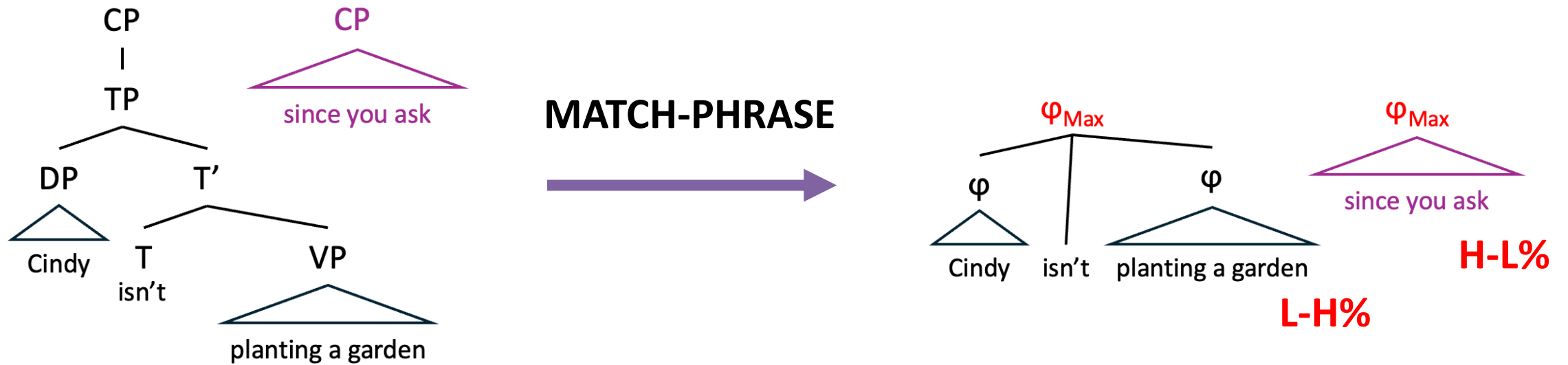


# Maximal $\varphi$

- For Type (c) **NonIC** (prosodically non-integrated adverbial clauses), it may help to assume that these are not truly part of the same clause in the narrow syntax.
- In terms of Match Theory, these types of NonIC would not be adjuncts to CP (as previously assumed) but rather syntactically **separate clauses**.
- Thus, **each CP** will map to its **own  $\varphi_{Max}$** .

# Maximal $\varphi$

## Type (c): NonIC (outside narrow syntax)



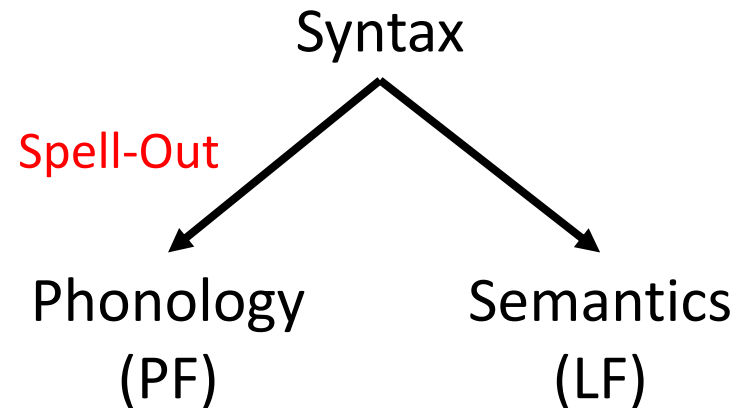
# Maximal $\varphi$

- Of course, there is still evidence that the two clauses are connected in the discourse.
- Prosodically, the choice of **L-H%** (“comma” intonation) suggests that the first clause is not final in the utterance.
- Perhaps the choice of boundary tone is also dependent on discourse factors, external to the syntax.

# **MSO-PI-PO**

# MSO-PI-PO

- In terms of architecture of the grammar, most work on the syntax-phonology interface assumes the “Y-model” of the grammar (Chomsky 1995):



# MSO-PI-PO

- In terms of Match Theory, syntactic spell-out (i.e. mapping from syntax to phonology) involves sending the **output of syntax** to the **input to phonology**.
- Spell-out involves a number of operations, including:
  - Vocabulary insertion
  - Prosodic structure (MATCH)
  - Linerization
  - Purely phonological constraints (e.g. binarity, equal sisters...)

# MSO-PI-PO

- In the model proposed by Selkirk (2011), all operations occur **simultaneously** under an OT model.
- In theory, operations like **linearization** can be influenced by prosodic structure (e.g. Bennett, Elfner & McCloskey 2016).

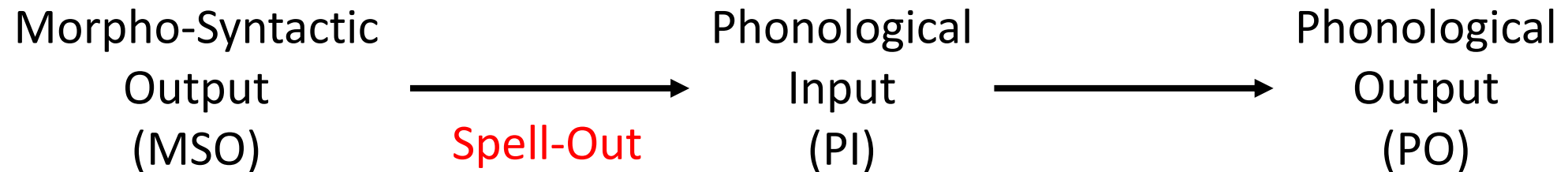
# MSO-PI-PO

- This model looks like this, with a **direct** relation between the Morpho-Syntactic Output (MSO) and the Phonological Output (PO):



# MSO-PI-PO

- More recent work (Kratzer & Selkirk 2020, Lee & Selkirk 2022) proposes that the relationship between MSO and PO is **indirect**, moderated by the **Phonological Input (PI)**:



# MSO-PI-PO

- This model of the syntax-phonology interface assumes:
  1. **Syntactic structure is first “spelled-out”**: this includes operations such as vocabulary insertion, prosodic structure assignment (via MATCH constraints but not interacting with purely phonological factors), and linearization.
  2. The output of this structure (PI) is then subjected to **“phonological spell-out”**, where purely phonological constraints interact with prosodic structure (but not directly with syntactic structure).

# MSO-PI-PO

- An interesting consequence of this proposal is that we are able to separate the **syntax-prosody interface** from other aspects of the final prosodic representation (PO).
- For example, elements which are not directly encoded in the syntactic structure (such as certain discourse structural elements) could be implemented at the level of PI-PO instead.

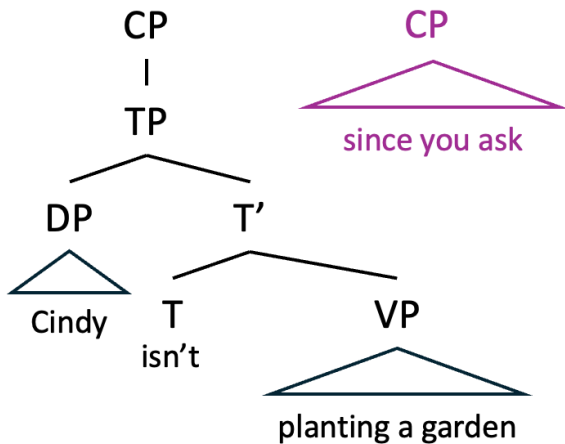
# MSO-PI-PO

- In terms of non-integrated adverbial clauses, perhaps they are disconnected at the level of the MSO-PI interface but are then integrated at the PI-PO interface.

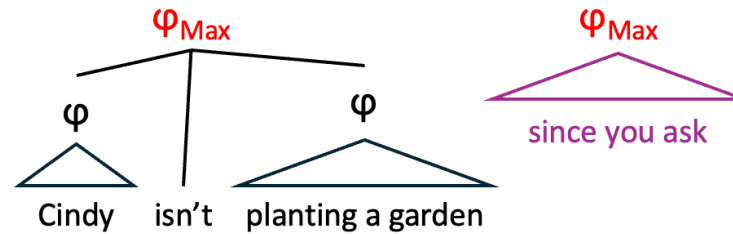
# MSO-PI-PO

## Type (c): NonIC (outside narrow syntax)

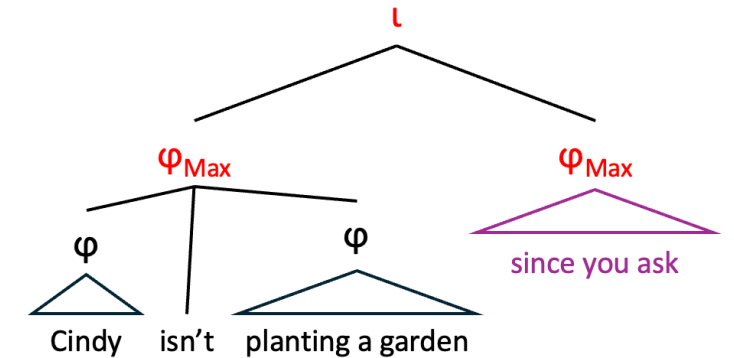
**MSO**



**PI**



**PO**

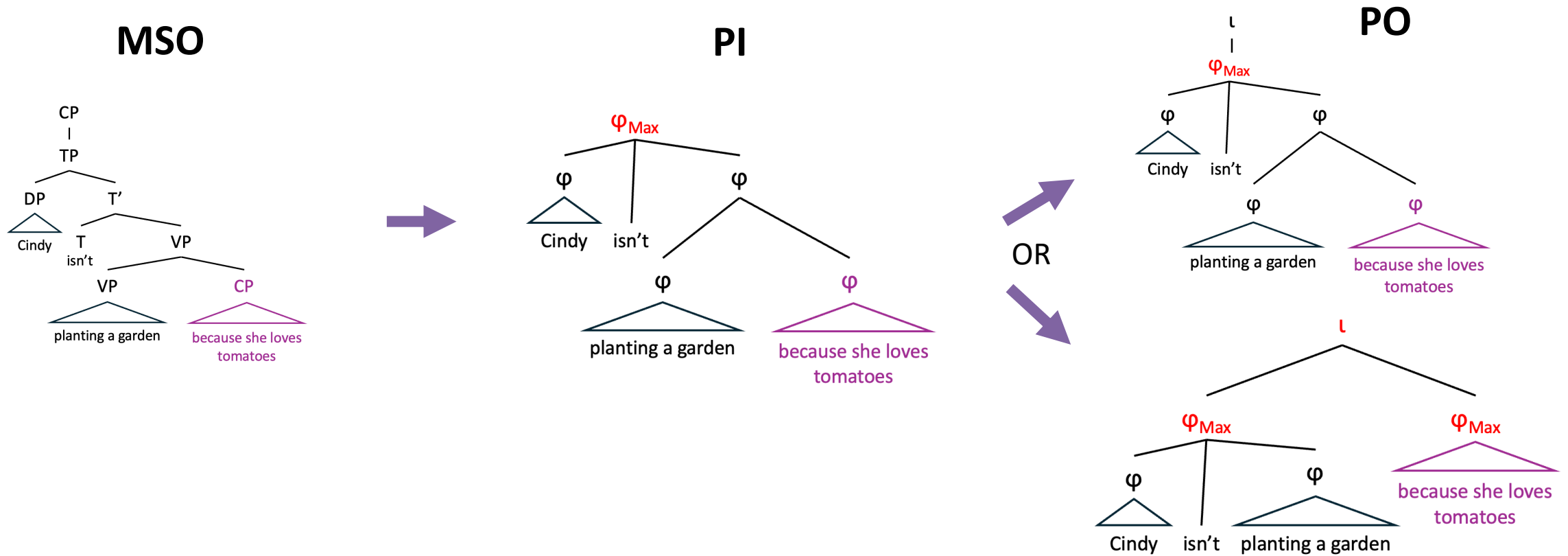


# MSO-PI-PO

- A further consequence is that this model allows us to assume that **surface variation** might occur at the interface between PI and PO, rather than MSO-PI.
- Thus, some of the observed patterns regarding **variable prosodic integration** might be captured at the **PI-PO interface**, (e.g. through prosodic operations like extraposition or phonological displacement – as suggested by Lee & Selkirk 2022, see e.g. Agbayani & Golston 2016).

# MSO-PI-PO

## Type (a): integrated (MSO-PI), (not) integrated (PI-PO)



# CONCLUSION

# Conclusion

- Match Theory provides a framework for capturing the relationship between **syntactic structure** and **prosodic structure**.
- Recent advancement in the **architecture of the interface** (i.e. MSO-PI-PO model) suggest that the output of morphosyntax (MSO) and the output of phonology (PO) is **indirectly mediated** by the phonological input (PI).

# Conclusion

- In the case of **adverbial clauses**, advancements in syntax, semantics and pragmatics/discourse suggest that:
  - The syntactic structure (MSO) is an important factor in determining whether or not the adverbial clause is prosodically integrated
  - However, there is variability in terms of how these are realized in the actual phonological output (PO).

# Conclusion

- While more work needs to be done, **Match Theory and the MSO-PI-PO model** may provide some needed flexibility in the prosodic realization of adverbial clauses (PO), while still allowing for a close relationship between syntactic and prosodic mapping (MSO-PI).

**Thank you!**

# Selected References

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