

# **Match Theory and the Asymmetry Problem: Intonational phrase marking in Stockholm Swedish**

Shinichiro Ishihara  
(Joint work with Sara Myrberg)

Lund University

Abstract:

This talk discusses an issue concerning one of the most substantial differences between Alignment Theories (Selkirk 1986, McCarthy & Prince 1993, Selkirk 1996 inter alia) and Match Theory (Selkirk 2011), namely, the (un)availability of asymmetric syntax–prosody mapping of right edges and left edges.

In the traditional Alignment Theories, syntax-prosody mapping constraints (Align-XP) are defined for left edges and right edges independently. Left and right edge mapping constraints can therefore be ranked differently with respect to other constraints. In Match Theory (Selkirk 2011), on the other hand, left- and right -edges of prosodic constituents are mapped to/from edges of syntactic constituents in a symmetric fashion. If there are cases where separate ranking of left- and right-edge mapping constraints is called for, these cases potentially pose a problem for Match Theory.

To illustrate this point, we discuss data from Stockholm Swedish, which has tonal phenomena that indicate both left and right edges of intonational phrases (Roll et al. 2009, Myrberg 2010, 2013, Myrberg & Riad 2015). Using these tonal cues, we discuss the syntax-prosody mapping of some syntactic structures in Swedish, and show that there are apparent cases of asymmetric mapping between left- and right edges. We propose that these apparent cases can be accounted for via the interaction between Match constraints and wellformedness constraints that govern the location of prosodic heads.

# The Asymmetry Problem and Match Theory

An example from Stockholm Swedish

Shinichiro Ishihara and Sara Myrberg  
Lund University

Nov. 18, 2017, SPOT Workshop, UCSC

1. Introduction
  - Match Theory vs. Alignment Theory
  - The Asymmetry Problem
2. Intonation Phrases in Stockholm Swedish
  - Big and small accent; Initiality accent; The right edge of IP
3. The Asymmetry Problem in Stockholm Swedish
  - Embedded clause word order
  - Phrasing of embedded clauses
  - An alignment-based account
4. A Match-based Account
  - Deriving the asymmetry from prosodic wellformedness
5. Concluding Remarks

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2

## Introduction

- Match Theory
- Match vs. Alignment
- Theoretical Implications
- The Asymmetry Problem

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3

## Match theory (Selkirk 2011)

- Syntax–Prosody Mapping [SP mapping]
  - a. [Clause ...] → {...}ι (Intonational Phrase, IP)
  - b. [Phrase ...] → (... )φ (Phonological Phrase, PP)
  - c. word → ω (Phonological Word, PW)
- Prosody–Syntax Mapping [PS mapping]
  - a. [Clause ...] ← {...}ι (Intonational Phrase, IP)
  - b. [Phrase ...] ← (... )φ (Phonological Phrase, PP)
  - c. word ← ω (Phonological Word, PW)

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4

## Match theory (Selkirk 2011)

- requires strict one-to-one correspondence:
  - Constituent/node correspondence
  - Each and every syntactic constituent is mapped to a corresponding prosodic constituent
 
$$\begin{array}{l} [[ \dots ] \dots ] \\ (( \dots ) \dots ) \end{array}$$
- Obligatory recursion:
  - Match constraints force prosodic recursion.
- No room for syntax–prosody mismatch
  - Match constraints themselves never allow non-isomorphism, i.e., non-isomorphism should arise exclusively through the interaction with other constraints.

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## Alignment theory

Selkirk 1986, 1996; Chen 1987; McCarthy & Prince 1993

- **Syntax–Prosody (SP) Mapping:** A pair of constraints
  - AlignL (XP,  $\varphi$ ) [Left alignment]  
The left edge of any syntactic XP must be aligned with the left edge of a phonological phrase ( $\varphi$ ).
  - AlignR(XP,  $\varphi$ ) [Right alignment]  
The right edge of any syntactic XP must be aligned with the right edge of a phonological phrase ( $\varphi$ ).
- **Prosody–Syntax (PS) Mapping:** A pair of constraints
  - AlignL( $\varphi$ , XP) [Left alignment]
  - AlignR( $\varphi$ , XP) [Right alignment]

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## Alignment theory

- allows many-to-one correspondence:
  - Boundary/edge correspondence
  - Two syntactic boundaries may correspond to a single prosodic boundary
 
$$\begin{array}{l} [[ \dots ] \dots ] \\ (\varphi \dots \dots ) \end{array}$$
- allows non-recursive structure:
  - Alignment constraints do not force prosodic recursion (but are in principle compatible with it).
- leaves room for syntax–prosody non-isomorphism

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7

## Match vs. Alignment

### Match Theory

- Strict SP/PS mapping
- requires strict one-to-one correspondence
- obligatory prosodic recursion

### Alignment Theory

- Loose SP/PS mapping
- allows many-to-one correspondence
- optional prosodic recursivity

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## Theoretical implications

- Since Match constraints require perfect syntax–prosody isomorphism, any deviation from it needs to be derived by other constraints, including Prosodic Wellformedness Constraints (PWCs).
- More interactions with PWCs are expected in Match Theory.

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## Theoretical implications

- Minimal (Syntax–Prosody) Interface Hypothesis
  - a. Any type of non-isomorphism between syntax and prosody is derived by prosodic wellformedness constraints, or other interface constraints, e.g., information structure-related constraints, but never by the syntax-prosody interface constraints.
  - b. Match constraints are the sole syntax–prosody interface constraints which refer to syntactic categories. No other constraint refers to syntactic categories like XPs (i.e., No constraints like Align-XP, Wrap-XP and Stress-XP).

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## Wrap-XP = MatchPhrase-Max

Ishihara 2014:

- The recursion-blockage problem in Japanese
- Wrap-XP = MatchPhrase-Max

	MATCH-MAX	MAXBIN	MATCH
Input: [[[A] <sub>1</sub> B] <sub>2</sub> C] <sub>3</sub> D] <sub>4</sub>			
a. (((A) <sub>a</sub> B) <sub>b</sub> C) <sub>c</sub> D) <sub>d</sub>		* <sub>c</sub> * <sub>d</sub> !	
b. ((A B) <sub>a</sub> (C D) <sub>b</sub> ) <sub>c</sub>		* <sub>c</sub>	* <sub>3</sub>
c. (A B) <sub>a</sub> (C D) <sub>b</sub>	* <sub>4</sub> !		* <sub>3</sub> * <sub>4</sub>

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11

## The asymmetry problem

- In Alignment Theory, it is possible to rank L- and R-alignment differently w.r.t. relevant PWCs, while such asymmetry is not allowed in Match.
- If cases exist where a separate ranking of left- and right-edge mapping constraints is called for (e.g., AlignR >> PWC >> AlignL), how does Match Theory deal with it?

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12

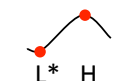
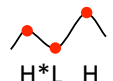
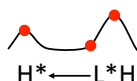
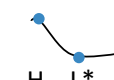
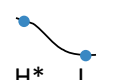
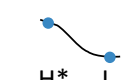
# Intonational Phrases in Stockholm Swedish

- Big and small accents
- Initiality accents (IA)
- The right edge of IP

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## Big and small accents

Stockholm Swedish tones (Bruce 1977, 1998)

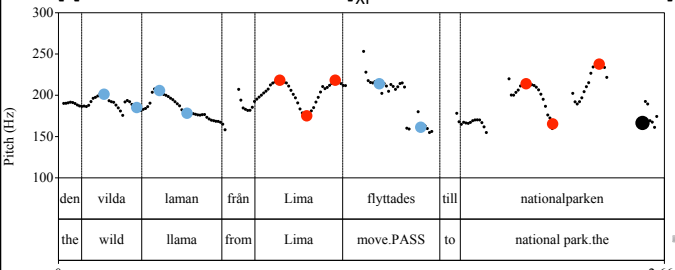
	TONE ACCENT 1	TONE ACCENT 2	TONE ACCENT 2, COMPOUNDS
<b>BIG ACCENT</b> (a.k.a. focal accent)	 L* H	 H* L H	 H* ← L* H
<b>SMALL ACCENT</b> (a.k.a. word accent)	 H L*	 H* L	 H* L

Terminology: big and small accent, see Myrberg & Riad (2015)

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## Big and small accents: single IP

$\{ ( ( S \ S \ \text{BIG} )_{PP} ( S \ \text{BIG}^{nuc} )_{PP} )_{IP} \}$   
 $[[ \quad ]_{XP} ]_{CP}$



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## Big accents

- Distribution largely comparable to pitch accents in West Germanic languages.
- Prenuclear:
  - Every big accent is head of some PP
  - Appears rightmost in PP (PP maps onto syntactic XP)
- Nuclear:
  - Head of IP
  - Rightmost big accent in IP
  - Obligatory inside Focus

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### Small accents

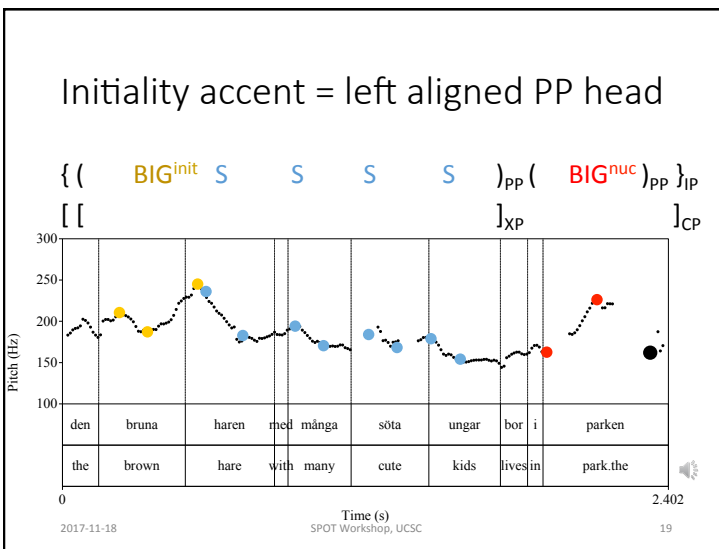
- Head of Prosodic word<sup>max</sup>
- Appears on most stressed words
  - Exceptions: some verbs, lexicalized phrases

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### Initiality accent (IA)

- Special type of prenuclear big accent
- Structurally — left aligned head of PP
  - Aligns with **left edge** of PP = Swedish PPs can be left or right headed. (Note: IP is always right headed)
- Functionally — marks the left edge of an intonational phrase (IP).
  - In a sequence of PPs inside IP, only the leftmost can be left-headed
  - No direct correlation with any information structural category

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### Initiality accent (IA)

- Mono-clausal CP (with IA)
 
$$[_{CP} [_{XP} ] \text{ verb } ] \{ ( \text{IA} ) ( \text{BIG}^{nuc} ) \}$$
- Mono-clausal CP (without IA)
 
$$[_{CP} [_{XP} ] \text{ verb } ] \{ ( \text{BIG} ) ( \text{BIG}^{nuc} ) \}$$

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### The right edge of IP

- The right edge of IP is signalled by a **big accent + L%**
  - (Note: there are other types of boundary tones.)
- Big accents followed by L% are per definition nuclear
- Cf. plateau after *Lima* (=no L%), vs. F0 fall after *nationalparken* (=L%)

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### Summary

- Big accent = head of PP
- Big nuclear accent = head of IP
- Initiality accent = left aligned head of (IP-initial) PP
- IP-boundary tone (L%)

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### The Asymmetry Problem in Stockholm Swedish

- Main clause (MC) and embedded clause (EC) word order
- Embedded clause with MC word order
- ECs in Spec,CP vs. VP-final EC
- Alignment-based account

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### Embedded clauses in Spec,CP vs. VP-final embedded clauses

- 1) Embedded clause in Spec,CP
 
$$CP [ CP [ ]_{CP} ]_{CP}$$
- 2) VP-final embedded clause
 
$$CP [ ]_{CP} CP [ ]_{CP}$$

- (1) and (2) do not exhibit parallel phrasing options

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### Embedded clauses in Spec,CP vs. VP-final embedded clauses

- 1) Phrasing options for [[...]...]
  - a. {{...} ... }
  - b. { ... ... }
  - c. {{...}{...}}
  
- 2) Phrasing options for [... [...]]
  - a. { ... {...}}
  - b. { ... ... }
  - c. \*{{...}{...}}

(Myrberg 2010:141, 2013)

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### Embedded clauses in Spec,CP

- 1) Phrasing options for [[...]...]
  - a. {{...} ... }
  - b. { ... ... }
  - c. {{...}{...}}
  
- The embedded clause may or may not be realized as an IP.
- There may be an additional IP after the embedded clause.

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### Embedded clauses in Spec,CP

a. {{ IA NUC } NUC }

[[Om sebrorna kom NÄRMARE] så skulle Ida kunna RÖRA vid dem.]

*if zebras came closer then would Ida be able to touch at them*

b. {{ IA NUC }

[[Om sebrorna kom närmare] så skulle Ida kunna RÖRA vid dem.]

*if zebras came closer then would Ida be able to touch at them*

c. {{ IA NUC } { IA NUC }

[[Om sebrorna kom NÄRMARE] så skulle Ida kunna RÖRA vid dem.]

*if zebras came closer then would Ida be able to touch at them*

(Myrberg 2010, 2013)

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a. {{ IA NUC L% } S NUC L% }

om	sebrorna	kom	närmare	så	skulle	Ida	kunna	röra	vid	dem
if	zebras-the	came	closer	so	would	Ida	could	touch	at	them

b. { IA S S NUC L% }

om	sebrorna	kom	närmare	så	skulle	Ida	kunna	röra	vid	dem
if	zebras-the	came	closer	so	would	Ida	could	touch	at	them

c. {{ IA NUC L% } { IA NUC L% }

in	hundar	ska	bli	rumsrena	så	måste	deras	ägare	lära	dem	det
if	dogs	will	be-	house	so	must	their	owners	teach	them	that

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### Embedded clauses in Spec,CP

1) Phrasing options for [ [ ... ] ... ]

- { { ... } ... }
- { ... ... }
- { { ... } { ... } }

- The additional IP in c. is *not* due to the presence of the subject NP.
  - It may appear in a mono-clausal sentence with the subject in Spec,CP

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### Subject in Spec,CP: IA on the verb

{ {IA NUC L%} {IA NUC L%} }

[ [De i SJ:s personal som oroar sig över passagerarnas **säkerhet**]<sub>Spec,CP</sub> **varnar** resenärerna för att lämna sitt bagage oövervakat i **hyllan**].<sub>CP</sub>

'Those in SJ's staff who are concerned about passengers' safety, warn travelers not to leave their luggage unattended on the shelf.'

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### Subject in Spec,CP: IA on the verb

{ {IA NUC L%} {IA NUC L%} }

( BIG ) ( BIG ) ( BIG ) ( BIG ) ( BIG )

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### VP-final embedded clauses

2) Phrasing options for [ ... [ ... ] ]

- { ... { ... } }
- { ... ... }
- \*{ { ... } { ... } }

- The embedded clause may or may not be realized as an IP.
- No additional IP after the embedded clause is created before the embedded clause.

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### Main & embedded clause word order

Word order in Main Clause vs. Embedded Clause

- Main clauses (MCs): finite verb precedes sentence adverb.
  - De **ville inte** läsa.  
they want not read  
'They don't want to read.'
- Embedded clauses (ECs): opposite order.
  - ... eftersom de **inte ville** läsa.  
'... because they don't want to read.'

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### VP-final embedded clauses with main clause word order

- Some embedded clauses can optionally have main clause word order (e.g., Telemann et al. 1999, Julien 2008, Peterson 2014)
- $_{CP}[Åklagaren hävdade$   
 $_{CP}[att föraren **hade inte** gjort något fel] $_{CP}]_{CP}$$
- $_{CP}[Åklagaren hävdade$   
 $_{CP}[att föraren **inte hade** gjort något fel] $_{CP}]_{CP}$$

'The prosecutor claimed that the driver did not do anything wrong'

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### Initiality accent in embedded clauses

- Embedded clauses with MC word order may appear with an initiality accent (IA).
- The embedded clause with an IA can be analyzed as an embedded IP contained in another IP:
- Main clause word order:
  - [ Åklagaren hävdade [ att föraren **hade inte** ... fel ] ]
  - { IA { IA BIG<sub>NUC</sub> }
- Embedded clause word order:
  - [ Åklagaren hävdade [ att föraren **inte hade** ... fel ] ]
  - { IA

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### EC with MC word order → initiality accent

EC with EC word order → no initiality accent

(e.g. Roll 2006, Roll et al. 2009, Myrberg 2010, 2013, Söderström 2017)

36

### VP-final embedded clauses: Summary

- The embedded clause may or may not be realized as an IP.
- The main clause material before the embedded clause cannot form an independent IA.

$\text{CP} [ \text{IP} \{ \text{IA} \}$ <p>1)</p> $\text{IP} \{ \text{IA} \}$ <p>2)</p> $\text{*IP} \{ \text{IP} \{ \text{IA} \}$	$\text{CP} [ \text{IP} \{ \text{IA} \}$ <p>2)</p> $\text{BIG} \} \text{IP} \{ \text{IP} \{ \text{IA} \}$	$\text{]CP } ] \text{CP}$ <p>1)</p> $\text{BIG}_{\text{nuc}} \} \text{IP} \} \text{IP}$ <p>2)</p> $\text{BIG}_{\text{nuc}} \} \text{IP}$ <p>3)</p> $\text{BIG}_{\text{nuc}} \} \text{IP} \} \text{IP}$
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### Alignment-based account

An alignment-based account adapted from Myrberg (2010):

- **Align(CP,t)-R [SP mapping]**  
The right edge of any CP in syntactic structure must be aligned with the right edge of an IP in prosodic structure.
- **Align(CP,t)-L [SP mapping]**  
The left edge of any CP in syntactic structure must be aligned with the left edge of an IP in prosodic structure.

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### Alignment-based account

- **Align(t,CP) [PS mapping]**  
An IP boundary in the output representation corresponds to a CP boundary in the input representation.
- **EqualSisters (Myrberg 2013) [PWC]**  
Sister nodes in prosodic structure are instantiations of the same prosodic category.
  - { ... ... }
  - { { ... } { ... } }
  - { { { ... } ... } } — violates EqualSisters
  - { ... { ... } } — violates EqualSisters

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### Alignment-based account

- **Align(CP,t)-R** is freely ranked with respect to **Align(t,CP)** and **EqualSisters**, allowing optional outputs, while **Align(CP,t)-L** is strictly ranked lower than **Align(t,CP)**.

Align(CP,t)-R	Align(t,CP)	EqSis
	Align(CP,t)-L	

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### Alignment-based account

- Phrasing options for  $[[ \dots ] \dots ]$

		ALIGNCP-R	ALIGN( $\iota$ ,CP)	EqSis
	Input: $[[ \dots ] \dots ]$			
a.	$\{ \{ \dots \} \dots \}$			*
b.	$\{ \dots \dots \}$	*		
c.	$\{ \{ \dots \} \{ \dots \} \}$		*	

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### Alignment-based account

- Phrasing options for  $[ \dots [ \dots ] ]$

		ALIGN( $\iota$ ,CP)	ALIGNCP-L	EqSis
	Input: $[ \dots [ \dots ] ]$			
a.	$\{ \dots \{ \dots \} \}$			*
b.	$\{ \dots \dots \}$		*	
c.	$\{ \{ \dots \} \{ \dots \} \}$	*!		

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### Alignment-based account

- Align-L/R was useful to express asymmetric behavior of left and right edges.
- How can we capture these facts with Match constraints?

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### A Match-based Account

- Deriving the asymmetry from prosodic wellformedness
- The account

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## Deriving the asymmetry from prosodic wellformedness

- Minimal (Syntax–Prosody) Interface Hypothesis
  - a. Any type of non-isomorphism between syntax and prosody is derived by prosodic wellformedness constraints, or other interface constraints, e.g., information structure-related constraints, but never by the syntax-prosody interface constraints.
  - b. Match constraints are the sole syntax–prosody interface constraints which refer to syntactic categories. No other constraint refers to syntactic categories like XPs (i.e., No constraints like Align-XP, Wrap-XP and Stress-XP).

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45

## Deriving the asymmetry from prosodic wellformedness

- The asymmetry problem in Stockholm Swedish can be explained in relation to prosodic prominence (i.e., heads of prosodic constituents), not by prosodic boundaries.
  - Prosodic constituents are either left or right headed. The distribution of the head can be regulated by AlignHead-L/R, or Edgemost(Prom- $\pi$ , Edge- $\pi$ ) (Selkirk 2011:471).
  - AlignHead is not a syntax-prosody interface constraint, but a prosodic wellformedness constraint (PWC). It requires a correspondence between two prosodic objects (prosodic heads and boundaries).

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46

## Deriving the asymmetry from prosodic wellformedness

- In other words, the asymmetry problem can be attributed to prosodic wellformedness, not to non-isomorphism in syntax–prosody mapping.
- In addition to AlignHead, \*Struc constraints ban unnecessary insertion of prosodic objects, e.g., \*PHead

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47

## Deriving the asymmetry from prosodic wellformedness

- Align( $\iota$ , L/R,  $\iota$ -Head, L/R) — AlignHead-L/R  
Align the left/right boundary of every intonation phrase with its head. (Truckenbrodt 1995:119, Féry 2013:696, and others)
- \*PHead( $\iota$ )  
Avoid heads of the IP ( $\iota$ ).

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48

## The account

- The Swedish data (repeated here, now with prosodic heads indicated by \*) can be solved by the combination of AlignHead and \*PHead.
- Phrasing options for [ [ ... ] ... ]
  - a. { { ... \* } ... \* }
  - b. { ... ... \* }
  - c. { { ... \* } { ... \* } }
- Phrasing options for [ ... [ ... ] ]
  - a. { ... { ... \* } }
  - b. { ... ... \* }
  - c. \* { { ... \* } { ... \* } }

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49

## The account

- A prosodic constituent is more difficult to insert or promote to a higher constituent if this insertion/promotion triggers insertion/promotion of an extra prosodic head as well.
- IP (boundary) insertion is allowed only when it does not change the number of prosodic heads.

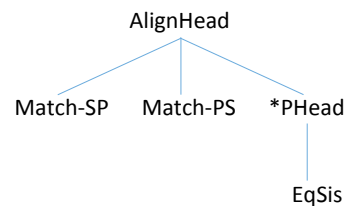
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50

## The account

- Two crucial rankings:
  - a. AlignHead-R >> \*PHead, Match-SP, Match-PS, EqSis
  - b. \*PHead >> EqSis



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51

## The account

- Two crucial rankings:
  - a. AlignHead-R >> \*PHead, Match-SP, Match-PS, EqSis
  - b. \*PHead >> EqSis
- The ranking in (a) ensures that there is no headless IPs.
- The free ranking of Match-SP, Match-PS, and EqSis results in phrasing optionality, along the lines of Myrberg (2010).
- The ranking in (b) successfully excludes the unwanted phrasing only in the right embedding case.

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52

### The account

- Match-SP, Match-PS >> \*PHead >> EqSis  
 → {{... \* } ... \* } and { ... { ... \* } }

Input: [[ ... ] ... ]	ALHD-R	MA-SP	MA-PS	*PHD	EqSis
a. $\{\{ * \} * \}$				**	*
b. $\{ * \}$		*!		*	
c. $\{\{ * \} \{ * \} \}$			*!	**	
d. $\{\{ * \} \}$	*!			*	*

Input: [ ... [ ... ] ]	ALHD-R	MA-SP	MA-PS	*PHD	EqSis
a. $\{ * \}$				*	*
b. $\{ * \}$		*!		*	
c. $\{\{ * \} \{ * \} \}$			*!	**	
d. $\{ * \}$	*!				*

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### The account

- \*PHead >> EqSis >> Match-SP, Match-PS  
 → { ... ... \* }

Input: [[ ... ] ... ]	ALHD-R	*PHD	EqSis	MA-SP	MA-PS
a. $\{\{ * \} * \}$		**!	*		
b. $\{ * \}$		*		*	
c. $\{\{ * \} \{ * \} \}$		**!			*
d. $\{\{ * \} \}$	*!			*	

Input: [ ... [ ... ] ]	ALHD-R	*PHD	EqSis	MA-SP	MA-PS
a. $\{ * \}$		*	*!		
b. $\{ * \}$		*		*	
c. $\{\{ * \} \{ * \} \}$		**!			*
d. $\{ * \}$	*!			*	

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### The account

- Match-PS >> \*PHead >> EqSis >> Match-SP  
 → { ... ... \* }

Input: [[ ... ] ... ]	ALHD-R	MA-PS	*PHD	EqSis	MA-SP
a. $\{\{ * \} * \}$			**!	*	
b. $\{ * \}$			*		*
c. $\{\{ * \} \{ * \} \}$		*!	**		
d. $\{\{ * \} \}$	*!				*

Input: [ ... [ ... ] ]	ALHD-R	MA-PS	*PHD	EqSis	MA-SP
a. $\{ * \}$			*	*!	
b. $\{ * \}$			*		*
c. $\{\{ * \} \{ * \} \}$		*!	**		
d. $\{ * \}$	*!				*

2017-11-18 SPOT Workshop, UCSC 55

### The account

- Match-SP >> \*PHead >> EqSis >> Match-PS  
 → **Divergent results!**

Input: [[ ... ] ... ]	ALHD-R	MA-SP	*PHD	EqSis	MA-PS
a. $\{\{ * \} * \}$			**	*!	
b. $\{ * \}$		*!	*		
c. $\{\{ * \} \{ * \} \}$			**		*
d. $\{\{ * \} \{ * \} \}$	*!		*		*

Input: [ ... [ ... ] ]	ALHD-R	MA-SP	*PHD	EqSis	MA-PS
a. $\{ * \}$			*	*	
b. $\{ * \}$		*!	*		
c. $\{\{ * \} \{ * \} \}$			**!		*
d. $\{\{ * \} \{ * \} \}$	*!		*		*

2017-11-18 SPOT Workshop, UCSC 56

## The account: Summary

- The Asymmetry Problem
  - There seem cases in which one side (L or R) seems to show a stronger effect than the other side, i.e., prosodic boundary strength seems often asymmetric.
  - IP phrasing in Stockholm Swedish
- Deriving the Asymmetry from PWCs
  - The Asymmetry Problem should be explained by PWCs, not by interface constraints (AlignXP or MatchPhrase).
  - In the case of SSw, the constraints regulating the distribution of prosodic heads (i.e., AlignHead and \*PHead) interact with Match-SP/PS to derived the asymmetry.

2017-11-18

SPOT Workshop, UCSC

57

## Concluding Remarks

- Match constraints requires perfect S-P isomorphism
  - Any non-isomorphism between syntax and prosody comes from interaction with PWCs
- Hypothesis: Match constraints are the sole interface constraints
  - Wrap-XP = MatchPhrase-Max (Ishihara 2014)
  - Align-XP = Match / AlignHead + \*PHead (PWCs)
  - Stress-XP = Match / AlignHead + \*PHead (PWCs)?

2017-11-18

SPOT Workshop, UCSC

58

## Concluding Remarks

- Minimal (Syntax–Prosody) Interface Hypothesis
  - a. Any type of non-isomorphism between syntax and prosody is derived by prosodic wellformedness constraints, or other interface constraints, e.g., information structure-related constraints, but never by the syntax-prosody interface constraints.
  - b. Match constraints are the sole syntax–prosody interface constraints which refer to syntactic categories. No other constraint refers to syntactic categories like XPs (i.e., No constraints like Align-XP, Wrap-XP and Stress-XP).

2017-11-18

SPOT Workshop, UCSC

59

Thank you

2017-11-18

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60



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2017-11-18

SPOT Workshop, UCSC

61

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2017-11-18

SPOT Workshop, UCSC

62

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2017-11-18

SPOT Workshop, UCSC

63