

## Asymmetries in grammar



Day 5: Adult sentence processing

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## Adult sentence processing

- Contrastive stress
- Delay in comprehension of marked stress
- Predictions for adult sentence processing
- Eye-tracking studies
- General conclusions

## Stress and focus

*Only* associates with focus (Rooth, 1985):

- Tigger only threw a CHAIR to Piglet.
  - ➔ The only thing Tigger threw to Piglet was a chair. (*direct object focus*)
- Tigger only threw a chair to PIGLET.
  - ➔ The only one Tigger threw a chair to was Piglet. (*indirect object focus*)
  - ➔ The only thing Tigger did was throwing a chair to Piglet. (*VP focus*)

## Szendrői (2004)

- TVJT with 28 Dutch children (age 4;1 - 6;10, mean age 5;5), of which 5 were excluded from further analysis
- Pre-recorded sentences
- Robbie the robot
- Story context with props
- Total of 6 stories (2 NS, 2 MS, 2 fillers)

## Example story

This is a story about Tigger, Piglet and Winnie the Pooh. They are playing in the garden. There is a lot of old furniture around. Tigger claims that he is really strong, in fact he is so strong that he can throw this big chair to Winnie. Winnie says: 'That's not possible. You can't be that strong!' But Tigger says: 'Look!' and throws the chair over to Winnie. Then Tigger says: 'I am very very strong! I can also throw this big table to Winnie.' Winnie says: 'Let me see whether you are really so strong. Throw the table over to me!' Tigger says: 'Look here!' and throws the table over to Winnie. But now Piglet (who is standing a little bit further away from Tigger than Winnie) says: 'You are really strong Tigger! But are you strong enough to throw something over to me? I am standing further away than Winnie. It is more difficult to throw something here. There is another chair in the corner. Can you see it? Throw it over to me if you are really so strong!' Tigger says: 'No problem. I can do that too. I am SOOOO strong!' and throws the chair over to Piglet. Piglet says: 'Well done. But there is also a wardrobe behind you. Can you throw that one over to me?' Tigger walks over to the wardrobe. It's really heavy. He can hardly lift it. In fact, it is so heavy that he cannot throw it over to Piglet. So he says: 'I am a little tired. And I already showed you how strong I was, so I am not throwing the wardrobe over to Piglet.'

## Neutral stress

- Hij heeft alleen een stoel naar KNORRETJE gegooid.  
'he only threw a chair to PIGLET'
- Adults: Ambiguous between narrow (indirect object) and wide (VP) focus, preference for narrow focus
- Children: 84.8% correct

## Marked stress

- Hij heeft alleen een STOEL naar Knorretje gegooid.  
'he only threw a CHAIR to Piglet'
- Adults: Only narrow (direct object) focus.
- Children: only 52.5% correct, also allowing wide (VP) focus:
  - adult-like group assigning narrow focus
  - non-adult-like group assigning wide focus, that also assigns wide focus to neutral stress

## Cutler & Swinney (1987)

- “The previous literature on the development of prosodic competence shows an apparent anomaly in that young children’s productive skills appear to outstrip their receptive skills” (p. 145)
- “In general, children’s semantic/pragmatic abilities follow the general rule of linguistic performance: production is at best as good as comprehension, it never outstrips it. Only prosodic performance seems to be an exception” (p. 162).

## Cutler & Swinney’s explanation

- Accenting is a primitive physiological reaction associated with speaker excitation (cf. Bolinger, 1983). No linguistic intention or underlying meaning representation needs to be involved in children’s correct production of contrastive accent.
- That is: Children’s production just *appears* to be correct.

## Reinhart (2006)

- Marked forms require reference-set computation.
- Same mechanism that was used to account for DPBE.
- Children guess (or use extra-linguistic strategy) when WM capacity is insufficient.
- OT analysis closely follows Reinhart (2006), except for WM explanation.

## Constraints

Faithfulness constraint:

- Mark Focus: The focus must contain the word carrying main stress.

Markedness constraint on forms:

- Nuclear Stress: The main stress must fall on the most deeply embedded constituent in the sentence. (cf. Chomsky and Halle, 1968; Cinque, 1993)

Markedness constraint on meanings:

- Bind Focus: The focus must be in the c-command domain of the focus particle *only*.

## Children’s production (1)

Input:	MARK	FAITH	MARK
focus on verb phrase	Bind Focus	Mark Focus	Nuclear Stress
stress on subject		*!	*
stress on verb			*!
stress on direct object			*!
stress on indirect object			

Tableau 1:

Production of VP focus

## Children's production (2)

Input:	MARK	FAITH	MARK
focus on indirect object	Bind Focus	Mark Focus	Nuclear Stress
stress on subject		*!	*
stress on verb		*!	*
stress on direct object		*!	*
☞ stress on indirect object			

Tableau 2:

Production of indirect object focus

## Children's production (3)

Input:	MARK	FAITH	MARK
focus on direct object	Bind Focus	Mark Focus	Nuclear Stress
stress on subject		*!	*
stress on verb		*!	*
☞ stress on direct object			*
stress on indirect object		*!	

Tableau 3:

Production of direct object focus

## Children's comprehension (1)

Input:	MARK	FAITH	MARK
stress on indirect object	Bind Focus	Mark Focus	Nuclear Stress
focus on subject	*!	*	
Focus on direct object		*!	
☞ Focus on indirect object			
☞ Focus on verb phrase			
Focus on sentence	*!		

Tableau 4:

Comprehension of stress on indirect object

## Children's comprehension (2)

Input:	MARK	FAITH	MARK
stress on direct object	Bind Focus	Mark Focus	Nuclear Stress
focus on subject	*!	*	
☞ focus on direct object			
focus on indirect object		*!	
☞ focus on verb phrase			
focus on sentence	*!		

Tableau 5:

Comprehension of stress on direct object

## Adults' pattern

	MARK	FAITH	MARK
	Bind Focus	Mark Focus	Nuclear Stress
1 <stress on direct object, focus on subject>	*	*	*
2 <stress on direct object, focus on direct object >			*
3 <stress on direct object, focus on indirect object>		*	*
4 <stress on direct object, focus on verb phrase>			*
5 <stress on direct object, focus on sentence>	*		*
6 <stress on indirect object, focus on subject>	*	*	
7 <stress on indirect object, focus on direct object>		*	
8 <stress on indirect object, focus on indirect object>			
9 <stress on indirect object, focus on verb phrase>			
10 <stress on indirect object, focus on sentence>	*		

Tableau 6: Bidirectional optimization

## Predictions OT for children

### Input:

- Focus on VP
- Focus on IO
- Focus on DO
- Stress on IO
- Stress on DO

→

### Optimal output:

- Stress on IO
- Stress on IO
- Stress on DO
- Focus on IO or VP
- Focus or DO or **VP**

### Adults:

- Stress on DO → only focus on DO

## Contrastive stress: Children's pattern

	Production	Comprehension (based on Szendrői)
<b>Neutral stress</b>	✓ (adult-like)	✓ (adult-like, but preference for wide focus)
<b>Marked stress</b>	✓ (adult-like)	✗ (preference for wide focus)

## Delay in comprehension

- For children, both stress on direct object (marked stress) and stress on indirect object (neutral stress) results in ambiguity.
- For adults, only stress on indirect object (neutral stress) results in ambiguity.
- ➔ Delay in comprehension of marked stress



## Adult sentence processing

Reinhart (2006):

- Reference-set computation is only required for marked forms.
- This additional operation is reflected in children's errors and in processing costs in adults.
- Prediction: For children as well as adults interpreting marked stress is more difficult than interpreting neutral stress.

## Predictions OT

- If:
  - bidirectional optimization takes place with unmarked as well as marked forms,
  - and ambiguity yields extra processing difficulties,
- Then:
  - adults are expected to experience more difficulty with neutral stress than with marked stress.

## Gennari, Meroni and Crain (2005)

- Eye-tracking study with head-mounted eye-tracker
- PVT: Accuracy, reaction times & eye movements
- 53 English adults
- 3 conditions (NS 1, MS, NS 2)
- Longer fixations are expected on focus and contrast set.

**NS 1:** The mother only brought some milk to the boy.

**MS:** The mother only brought SOME MILK to the boy.

**NS 2:** The mother only brought the boy some milk.



Longer fixations are predicted on:

Gennari et al.'s on-line model:

	Focus	Contrast set
NS 1	boy (boy's milk)	man (man's coffee)
MS	boy's milk	man's coffee
NS 2	boy's milk (boy)	man's coffee (man)

Shorter fixations on boy/man →

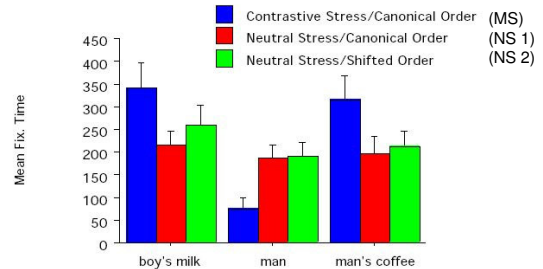
Reinhart's interface model:

	Focus	Contrast set
NS 1	boy	man
MS	boy's milk boy	man's coffee man
NS 2	boy's milk	man's coffee

Long fixations on all entities →

## Results Gennari et al.

Fig. 2



## Conclusions Gennari et al.

- Fixation patterns suggest ambiguity with neutral stress, but not with marked stress.
- More correct responses with marked stress (MS: 84%, NS 1: 70%, NS 2: 71%).
- Faster responses with marked stress.
- ➔ Marked stress facilitates sentence comprehension for adults (cf. predictions OT, contra predictions Reinhart).

## On-line comprehension pronouns



- In contrast to unmarked stress, reflexives are not ambiguous.
- But pronouns initially are.
- Therefore, different predictions for on-line comprehension of pronouns.

## Predictions OT

- If:
  - bidirectional optimization takes place with unmarked as well as marked forms,
  - and ambiguity yields extra processing difficulties,
- Then:
  - adults are expected to experience more *early* difficulty with pronouns than with reflexives.

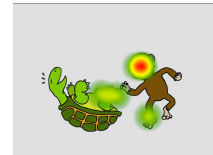
## Banga (2008) (preliminary results)

- Remote eye-tracker
- DPBE
- 24 Dutch adults
- TVJT/PVT: Accuracy, reaction times & eye-movements
- Longer fixations are expected on subject and object (= referents considered as antecedent for object anaphor)

## On-line study of DPBE

- DPBE in 2 conditions (cf. Spenader, Smits & Hendriks, 2009):
- Classic condition:
  - Here you see a monkey and a turtle.  
The monkey is tickling him/himself.
- Single topic condition:
  - Here you see a turtle.  
The monkey is tickling him/himself.

## The monkey is tickling him/himself



## OT and context

- Children use contextual cues to arrive at interpretation (see Spenader et al., 2009):
    - Constraint: Pronouns refer to topics.
  - For bidirectionally optimizing adults, context does not influence interpretation of pronouns.
- ➔ Additional prediction: On-line effects of context stronger for children than for adults.

## Longer fixations are predicted on:

		<i>Adults</i>	<i>Children</i>
	Subject	Anaphoric object	Anaphoric object
<i>Classic condition: reflexive</i>	monkey	monkey	monkey
<i>Classic condition: pronoun</i>	monkey	turtle (monkey)	turtle + monkey
<i>Single Topic condition: reflexive</i>	monkey	monkey	monkey
<i>Single Topic condition: pronoun</i>	monkey	turtle (monkey)	turtle

## Results adults' accuracy & RT

### Accuracy:

- No comprehension errors

### Reaction times:

- Reaction times were longest with pronouns in Classic condition (compared to pronouns in Single Topic condition and reflexives in both conditions)

➔ Conform children's off-line responses (& conform predictions Reinhart)

## Results adults' eye-movements

- Main effect of type of anaphor:
  - Participants took longer to fixate on correct antecedent for pronoun than for reflexive.
  - Participants looked shorter at correct antecedent for pronoun than for reflexive.
- No effects of context:
  - No difference between the two conditions.

➔ Different from children's off-line responses! (conform predictions OT, contra Reinhart)

## Discussion

- Predictions OT about absence of context effects in adult on-line processing is borne out by eye-movements.
- But how do we explain effects of context with reaction times?
- Perhaps early effects (sentence interpretation) vs. late effects (discourse integration)

## Asymmetries in language acquisition

	Early delay	Late delay
<b>Delay in production</b>	Early words	Anaphoric subjects
<b>Delay in comprehension</b>	Subject-object word order	DPBE, Object scrambling, Indefinite subjects, Contrastive stress, Aspect in Dutch (van Hout, 2006)

## OT account of asymmetries

- Early delays arise as a result of an incorrect constraint ranking.
- Late delays arise as a result of the inability to take into account the opposite perspective.

## General conclusions

Production/comprehension asymmetries:

- Occur at various ages in child language
  - Occur in various domains of grammar
  - May disappear under special circumstances (speech rate, context)
  - Re-appear again in the elderly
  - Sometimes surface in healthy adults
- AND: Are predicted by an OT grammar

## Other bidirectional OT accounts

- Bouma (2008, PhD thesis): Word order freezing in Dutch
- H. de Swart: Double negation in negative concord languages
- H. de Swart & Zwarts: Bare singulars (*to be in prison* vs. *to be in the prison*)
- P. de Swart (2007, PhD thesis): Case marking
- Zwarts: Prepositional meanings

→ Can more asymmetries be predicted on the basis of these OT accounts?

## Other attested asymmetries

- Prepositional phrases in English (Hurewitz, Brown-Schmidt, Thorpe, Gleitman & Trueswell, 2000)
- Relative clauses in Swedish (Håkansson & Hansson, 2000) and Hebrew (Botwinik-Rotem, 2008)
- Scalar implicatures (e.g., Noveck, 2001)
- *Why* questions in English (Conroy & Lidz, 2006)
- Evidentiality in Korean (Papafragou, Li, Choi & Han, 2006)

→ Can these asymmetries be given an OT account?

And more asymmetries to  
discover ...?

### Finally:

- Conference RASCAL: Relating Asymmetries between Speech and Comprehension in the Acquisition of Language
- Saturday, January 24 + Sunday, January 25, 2009
- Location: Hampshire Hotel Groningen, Radesingel 50
- Speakers: Eve Clark, Helen Tager-Flusberg, a.o., + Panel discussion on Saturday