Finnish word order

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The problem

- *'Jari gave a book to Merja.'*

- Jari antoi kirjan Merjalle   Kirjan antoi Jari Merjalle
- Merjalle antoi kirjan Jari   Merjalle antoi Jari kirjan
- Antoi Jari kirjan Merjalle   Antoi kirjan Jari Merjalle
- Antoi Merjalle kirjan Jari   Antoi Merjalle Jari kirjan
- Jari kirjan antoi Merjalle   Kirjan Jari antoi Merjalle
- Jari Merjalle kirjan antoi   Jari Merjalle antoi kirjan
- Kirjan Merjalle antoi Jari   Kirjan Merjalle Jari antoi
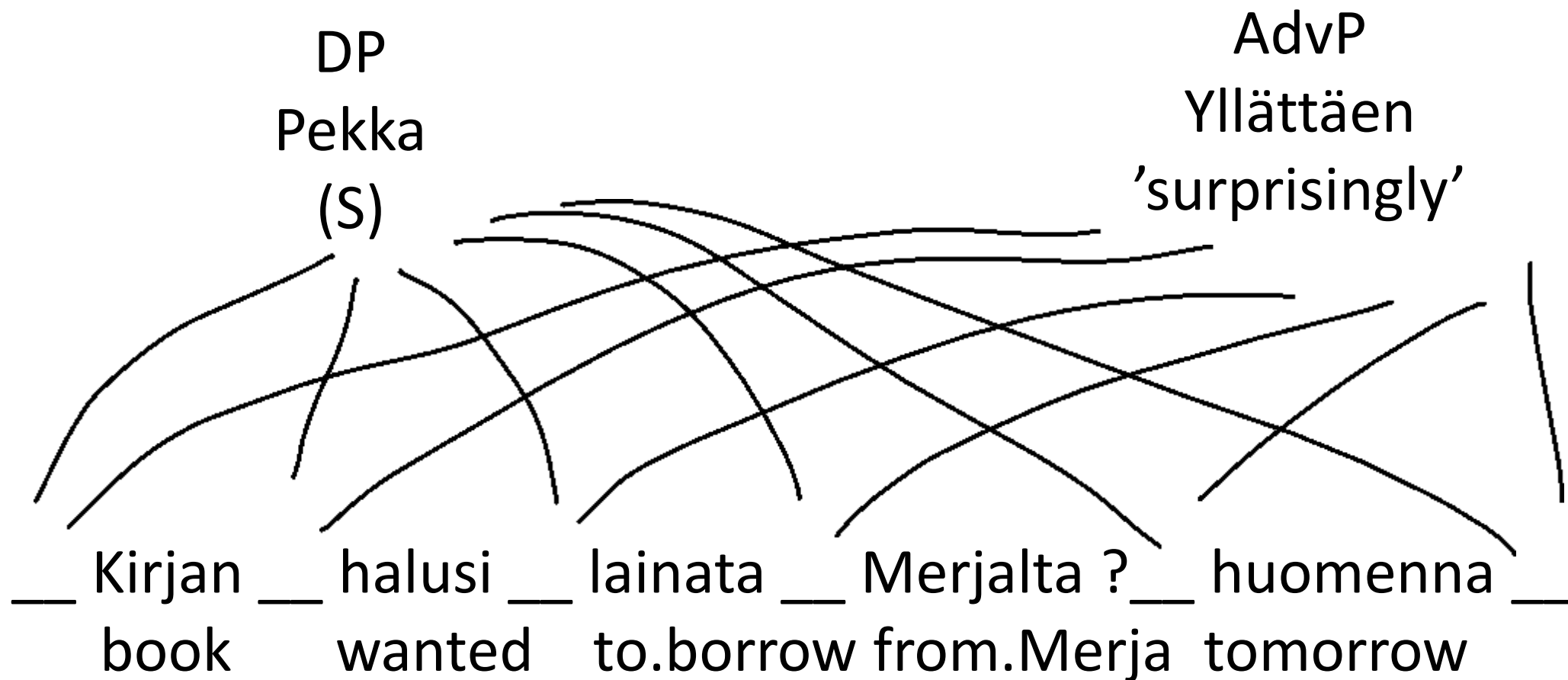
Nonconfigurationality hypothesis?

Finnish word order is like Hungarian, but without (any evidence of) nonconfigurationality

Movement hypothesis?

The word order is "too free" to be <u>all</u> captured by movement (compare Hungarian postverbal syntax). Something else is (also) going on.

Chomsky 1995: 4.7.3

Adjunction hypothesis?

In addition to standard movement, in Finnish thematic arguments can be adjoined to the sentence (i.e. they are syntactically adverbials)

DP
Pekka
(S)

AdvP
Yllättäen
'surprisingly'

__ Kirjan __ halusi __ lainata __ Merjalta ?__ huomenna __
book   wanted   to.borrow from.Merja tomorrow

⇒ We add this option, "argument floating," to the standard Merge/Move toolkit. The operation is licensed by rich case feature (e.g., NOM) of the argument. English etc does not have this option.

What the properties of argument floating are? My first research agenda failed

- I took various types of finite seed clauses, generated all word orders (119,800 sentences) and started reading them to find out what the ordering principles could be

- Problems:

Many theoretically interesting word orders could not be judged clearly

Statistics from one representative corpus:

75% word orders ungrammatical

20% grammatical but marginal

5% clean

Marginality is not irregular or random!

Examples:

?? Heidän antaa kirjan Merjalle käski Pekka

They.gen to.give book to.Merja ordered Pekka

'Pekka ordered them to give a book to Merja.'

?? Merjalle heidän käski antaa Pekka kirjan

to.Merja they.gen ordered to.give Pekka book

'Pekka ordered them to give a book to Merja.'

(?)* IHAILLA käski Pekka Merjaa heidän

To.admire ordered Pekka Merja they.gen

'Pekka ordered them to ADMIRE (and not HATE) Merja.'

I could not proceed without having some principled way of dealing with marginality and marginal sentences.

A hypothesis

- Could marginality be a language comprehension/parsing issue?

- Hypothesis: Some sentences are "unnatural" for the human parser and therefore perceived as "weird".

- To pursue this agenda we need a model of language comprehension

Assume the simplest model of language comprehension possible

- *John*   +   *admires*   +   *Mary* + . . .

    ↓   ↓   ↓

- [John   [admires   Mary]] . . .

One-dimensional PF input guides Merge/Move/Agree, and not just "free will" as in the standard theories

Phillips (1996), Chesi (2004...)

Add the adjunction operation in its arsenal

Free word order (Finnish): arguments are first merged into "tentative" positions based on their surface order, and are reconstructed, based on case features, into the canonical positions as if they were adjuncts/adverbials

Fixed word order (English): first positions are also canonical positions (modulo A´/A-reconstruction)

Marginality = computational complexity

Baker 1996, Chomsky 1995: 4.7.3, Brattico 2016, 2018

Step 1. Use the input sentence to guide Merge

Kirjan + halusi + lainata + Merjalta + Pekka

$\downarrow$ $\downarrow$ $\downarrow$ $\downarrow$ $\downarrow$

[Kirjan [halusi [lainata [Merjalta Pekka]]]
book.acc wanted to.borrow from.Merja Pekka.nom

Step 2. Promote arguments in wrong positions into adjuncts

[⟨Kirjan⟩ [halusi [lainata   [Merjalta ⟨Pekka⟩]]]

Step 3. "Float" the arguments to canonical positions

[⟨Kirjan⟩ [halusi [__ lainata __ [Merjalta ⟨Pekka⟩]]]

To test the idea, the hypothesis was implemeneted as a computer program (a "parser" that uses Merge/Move/Agree)

- Source code at https://github.com/pajubrat/parser-grammar

The model understands Finnish seed sentences correctly and efficiently (no backtracking)

1. Pekka nukkui
   [‹ D Pekka › :1 [T/fin [‹ DP › :1 nukku]]]
      Pekka   sleep

2. Pekka ihailee Merjaa
   [‹ D Pekka › :2 [T/fin [‹ DP › :2 [v [ihailee [D Merjaa]]]]]]
      Pekka   admire   Merja

3. Pekka antoi kirjan Merjalle
   [‹ D Pekka › :4 [T/fin [‹ DP › :4 [v [antaa [[D kirja] ‹ P(lle) [D Merja-] ›]]]]]]
      Pekka   give   book   to   Merja

4. Pekka ei nukkunut
   [‹ D Pekka › :1 [ei [‹ DP › :1 [T [‹ DP › :1 nukku]]]]]
      Pekka   not   sleep

5. Pekka ei ihaile Merjaa
   [‹ D Pekka › :3 [ei [‹ DP › :3 [T [‹ DP › :3 [v [ihailee [D Merjaa]]]]]]]]
      Pekka   not   admire   Merja

6. Pekka ei antanut kirjaa Merjalle
   [‹ D Pekka › :7 [ei [‹ DP › :7 [T [‹ DP › :7 [v [antaa [[D kirja] ‹ P(lle) [D Merja-] ›]]]]]]]]
      Pekka   not   give   book to   Merja

7. Pekka kaski heidan nukkua
   [‹ D Pekka › :4 [T/fin [‹ DP › :4 [käske [[D heidän]:5 [Ainf [(DP):5 nukku]]]]]]]
      Pekka   order   they.gen to   sleep

8. Pekka kaski heidan ihailla Merjaa
   [‹ D Pekka › :8 [T/fin [‹ DP › :8 [käske [[D heidän]:9 [Ainf [(DP):9 [v [ihailee [D Merjaa]]]]]]]]]]
      Pekka   order   they.gen to   admire   Merja

9. Pekka kaski heidan antaa kirjan Merjalle
   [‹ D Pekka › :16 [T/fin [‹ DP › :16 [käske [[D heidän]:17 [Ainf [(DP):17 [v [antaa [[D kirja] ‹ P(lle) [D Merja-] ›]]]]]
      Pekka   order   they.gen to   give   book   to   Merja

10. Pekka nukkui kuorsaamalla
    [‹ D Pekka › :3 [T/fin [‹ DP › :3 [nukku ‹ malla kuorsaa ›]]]]
       Pekka   sleep   by   snoring

11. Pekka hairitsee Merjaa kuorsaamalla
    [‹ D Pekka › :4 [T/fin [‹ DP › :4 [v [hairitsee [[D Merjaa] ‹ malla kuorsaa ›]]]]]]
       Pekka   distrup   Merja   by   snoring

12. Pekka antoi kirjan Merjalle heittamalla
    [‹ D Pekka › :6 [T/fin [‹ DP › :6 [v [antaa [[D kirja] ‹ ‹ P(lle) [D Merja-] › ‹ malla heitta › ›]]]]]]
       Pekka   give   book   to   Merja   by   throwing

13. Pekka ei nukkunut kuorsaamalla
    [‹ D Pekka › :5 [ei [‹ DP › :5 [T [‹ DP › :5 [nukku ‹ malla kuorsaa ›]]]]]]
       Pekka   not   sleep   by   snoring

14. Pekka ei hairitse Merjaa kuorsaamalla
    [‹ D Pekka › :7 [ei [‹ DP › :7 [T [‹ DP › :7 [v [hairitsee [[D Merjaa] ‹ malla kuorsaa ›]]]]]]]]
       Pekka   not   disturb   Merja   by   snoring

15. Pekka ei antanut kirjaa Merjalle heittamalla
    [‹ D Pekka › :11 [ei [‹ DP › :11 [T [‹ DP › :11 [v [antaa [[D kirja] ‹ ‹ P(lle) [D Merja-] › ‹ malla heitta › ›]]]]]]]]
       Pekka   not   give   book   to   Merja   by   throwing

16. Pekka ei kaskenyt heidan nukkua
    [‹ D Pekka › :7 [ei [‹ DP › :7 [T [‹ DP › :7 [käske [[D heidän]:9 [Ainf [(DP):9 nukku]]]]]]]]]
       Pekka   not   order   they.gen to   sleep

17. Pekka ei kaskenyt heidan ihailla Merjaa
    [‹ D Pekka › :13 [ei [‹ DP › :13 [T [‹ DP › :13 [käske [[D heidän]:15 [Ainf [(DP):15 [v [ihailee [D Merjaa]]]]]]]]]]]]
       Pekka   not   order   they.gen to   admire   Merja

18. Pekka ei kaskenyt heidan antaa kirjaa Merjalle
    [‹ D Pekka › :25 [ei [‹ DP › :25 [T [‹ DP › :25 [käske [[D heidän]:27 [Ainf [(DP):27 [v [antaa [[D kirja] ‹ P(lle) [D Merja-] ›]]]]]]]]]]]]]
       Pekka   not   order   they.gen to   give   book   to   Merja

19. Pekka kaski heidan nukkua kuorsaamalla
    [‹ D Pekka › :12 [T/fin [‹ DP › :12 [käske [[D heidän]:13 [Ainf [(DP):13 [nukku ‹ malla kuorsaa ›]]]]]]]]
       Pekka   order   they.gen to   sleep   by   snoring

20. Pekka kaski heidan hairita Merjaa kuorsaamalla
    [‹ D Pekka › :16 [T/fin [‹ DP › :16 [käske [[D heidän]:17 [Ainf [(DP):17 [v [hairitsee [[D Merjaa] ‹ malla kuorsaa ›]]]]]]]]]]
       Pekka   order   they.gen to   disturb   Merja   by   snoring

21. Pekka kaski heidan antaa kirjan Merjalle heittamalla
    [‹ D Pekka › :24 [T/fin [‹ DP › :24 [käske [[D heidän]:25 [Ainf [(DP):25 [v [antaa [[D kirja] ‹ ‹ P(lle) [D Merja-] › ‹ malla heitta › ›]]]]]]]]]]
       Pekka   order   they.gen to   give   book   to   Merja   by   throwing

22. Pekka ei kaskenyt heidan nukkua kuorsaamalla
    [‹ D Pekka › :19 [ei [‹ DP › :19 [T [‹ DP › :19 [käske [[D heidän]:21 [Ainf [(DP):21 [nukku ‹ malla kuorsaa ›]]]]]]]]]]
       Pekka   not   order   they.gen to   sleep   by   snoring

23. Pekka ei kaskenyt heidan hairita Merjaa kuorsaamalla
    [‹ D Pekka › :25 [ei [‹ DP › :25 [T [‹ DP › :25 [käske [[D heidän]:27 [Ainf [(DP):27 [v [hairitsee [[D Merjaa] ‹ malla kuorsaa ›]]]]]]]]]]]
       Pekka   not   order   they.gen to   disturb   Merja   by   snoring

24. Pekka ei kaskenyt heidan antaa kirjaa Merjalle heittamalla
    [‹ D Pekka › :37 [ei [‹ DP › :37 [T [‹ DP › :37 [käske [[D heidän]:39 [Ainf [(DP):39 [v [antaa [[D kirja] ‹ ‹ P(lle) [D Merja-] › ‹ malla heitta › ›]]]
       Pekka   not   order   they.gen to   give   book   to   Merja   by   throwing

Does it understand also noncanonical word orders??

- **Stimulus**. All possible word orders from the 24 seed sentences = 119,800 unique Finnish finite clauses
- **Procedure**. Check the output against (blind) native speaker judgment of the same data

```
847
848  254. * antanut Pekka ei kirjaa Merjalle
849
850  255. * antaa Merjalle heidan Pekka kirjan kaski
851
852  256. ?? heidan Merjaa ihailla kaski Pekka
853  [[[[D heidän]:7 [<D Merjaa>:6 [Ainf [(DP):7 [v [<DP>:6 ihailee]]]]]]]:11 [T/fin [<DP>:12 [käske (INFP):11]]]]
854  'D theirs D to __v __admire T __ask __D Pekka .'
855  Score: -4.0  (Failed: 1, Merge:17, Move: 14 = Ops: 31; Discourse plausibility: -3.0)
856
857  257. ?* kaski#foc Pekka kirjan Merjalle heidan antaa
858  [C [<D Pekka>:21 [T/fin [<DP>:21 [käske [<D kirja>:22 [<P(lle) [D Merja-]>:23 [[D heidän]:24 [Ainf [(DP):24 [
859  'C/fin D Pekka T __ask D book for D Merja D theirs to __v __give __.'
860  Score: -5.5  (Failed: 4, Merge:41, Move: 102 = Ops: 143; Discourse plausibility: -1.5)
861
862  258. (?) kirjan kaski Merjalle heidan antaa Pekka
863  [<D kirja>:17 [T/fin [<DP>:19 [käske [<P(lle) [D Merja-]>:18 [[D heidän]:20 [Ainf [(DP):20 [v [[<DP>:17 [anta
864  'D book T __ask for D Merja D theirs to __v __give D Pekka __.'
865  Score: -1.0  (Failed: 0, Merge:18, Move: 41 = Ops: 59; Discourse plausibility: -1.0)
866
867  259. * antaa kirjan kaski heidan Pekka Merjalle
868
869  260. * heidan#foc kirjan Merjalle Pekka antaa kaski
870
871  261. * Merjaa#foc ihailla heidan Pekka kaski
872
873  262.  Merjalle antoi kirjan Pekka heittamalla
874  [<P(lle) [D Merja-]>:10 [T/fin [<DP>:12 [v [<DP>:11 [[antaa [<D kirja>:11 <<D Pekka>:12 <malla heitta>>]] <PP
875  'for D Merja T __v __give D book D Pekka by throw __.'
876  Score: 0  (Failed: 0, Merge:15, Move: 32 = Ops: 47; Discourse plausibility: -0)
877
878  263. (?) kirjan#foc kaski heidan Pekka antaa Merjalle
879  [<D kirja>:17 [T/fin [<DP>:18 [käske [[D heidän]:19 [<D Pekka>:18 [Ainf [(DP):19 [v [<DP>:17 [antaa <P(lle) [
880  'D book T __ask D theirs D Pekka to __v __give for D Merja .'
881  Score: -1.0  (Failed: 0, Merge:19, Move: 35 = Ops: 54; Discourse plausibility: -1.0)
882
883  264. ?(*) heidan Pekka kirjan Merjalle kaski antaa
884  [[D heidän]:38 [<D Pekka>:35 [<D kirja>:36 [<P(lle) [D Merja-]>:37 [T/fin [<DP>:35 [käske [(DP):38 [Ainf [(DP
885  'D theirs D Pekka D book for D Merja T __ask __to __v __give __.'
886  Score: -5.0  (Failed: 3, Merge:44, Move: 66 = Ops: 110; Discourse plausibility: -2.0)
887
```

<= output summary file

Grammaticality/marginality

Computations performed

Grammatical analysis
(semantic interpretation)

• Detailed output (log file of the whole derivation, each step)

```
28389
28390  9.
28391
28392        Consume "Pekka"
28393
28394        [T{v,V} [[P(lle) [D Merja-]] D]] + Pekka
28395            Filtering out impossible merge sites...
28396            Sink "Pekka" into D because they are inside the same phonological word.
28397        Exploring solution number (1) =[D*Pekka]
28398            =[T{v,V} [[P(lle) [D Merja-]] D{N}]]
28399
28400  10.
28401
28402        Consume "ei"
28403
28404        [T{v,V} [[P(lle) [D Merja-]] D{N}]] + ei
28405            Filtering out impossible merge sites...
28406                Reject [[T [v [[antaa [<P(lle) [D Merja-]> [D Pekka]]] <P(lle) [D Merja-]>]]] ei] due to b
28407                Reject [[[P [D N]] D] ei] as Spec because it breaks words.
28408        Exploring solution number (1) =[D{N} ei]
28409            D was opened.
28410            =[T{v,V} [[P(lle) [D Merja-]] [[D Pekka] ei]]]
28411
28412  11.
28413        Next word contains multiple morphemes ['$par', '$D', 'kirja-']
28414        Storing inflectional feature ['-', 'LANG:FI', 'TAIL:!COMP:*,-PHI'] into working memory.
28415
28416        Consume "$D"
28417
28418            =[T{v,V} [[P(lle) [D Merja-]] [[D Pekka] ei]]]
28419
28420  12.
28421
28422        Adding inflectional features {'LANG:FI', '-', 'TAIL:!COMP:*,-PHI'} to D
28423        = ['!COMP:*', '!PROBE:CAT:N', '+PHI', '-', '-COMP:T/fin', '-COMP:uR', '-SPEC:*', 'CAT:D', 'COMP:N'
28424
28425        Consume "D"
28426
28427        [T{v,V} [[P(lle) [D Merja-]] [[D Pekka] ei]]] + D
28428            Filtering out impossible merge sites...
28429            Ranking remaining sites...
28430                Avoid TP as SPEC for D due to unselective SPEC feature.
28431                An EPP-head "v" lacks specifier D that it requires.
28432                antaa (antaa) is missing a mandatory complement D
28433                "antaa" has wrong complement [<P(lle) [D Merja-]>:3 [[[D Pekka] ei] <PP>:3]] [FIN][FIN/NEG
```
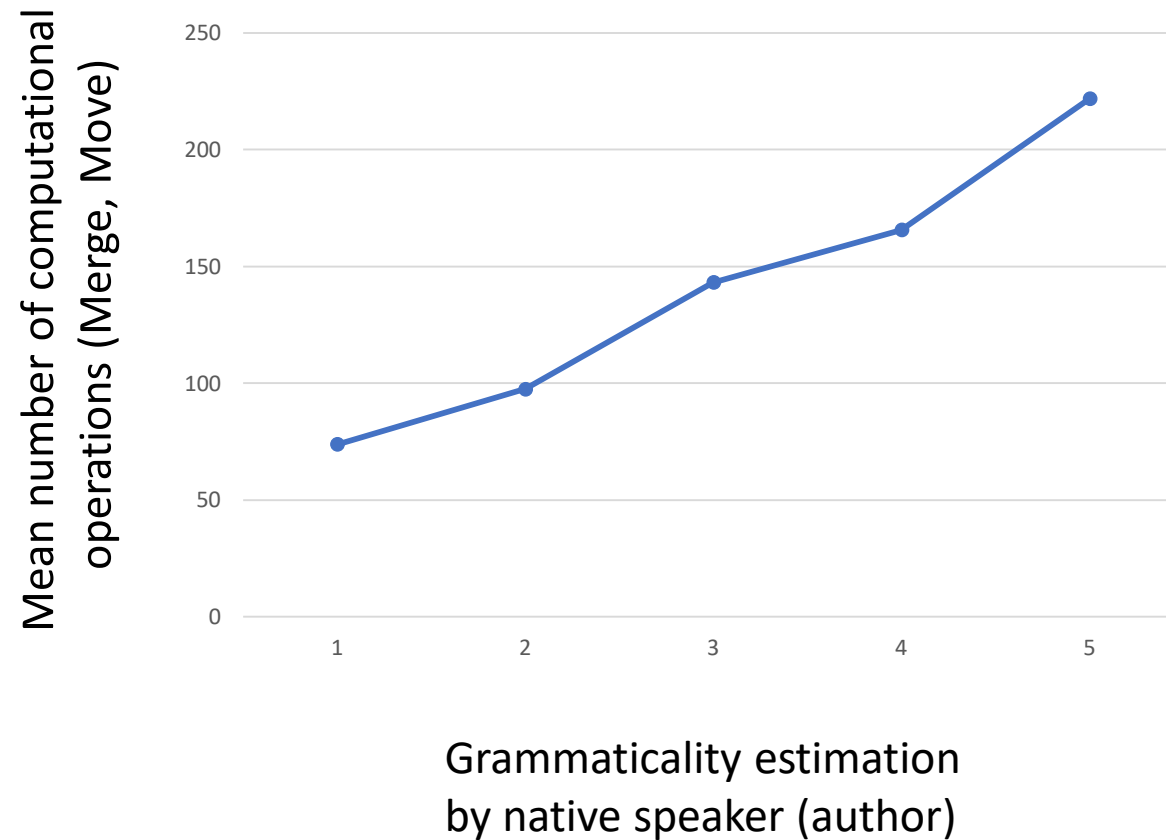
Small part of its "reasoning" when it tries to merge incoming elements into the phrase structure

Results

Marginality judgments did correlate with complexity (garden-pathing)

EXAMPLE SENTENCES FROM STUDY 3

In the order of marginality, as judged both by native speaker and the model

Sentence	Order	Native Speaker	Model
24. kuorsaamalla#foc hairitsee Merjaa Pekka	Adv-V-O-S	.	.
25. ei#foc Pekka ihaile Merjaa	n-S-V-O	.	.
32. heidan#foc Pekka kaski antaa Merjalle kirjan	s-S-V-v-IO-O	.	.
48. Pekka kaski heidan ihailla Merjaa	S-V-s-v-O	.	.
58. heittamalla#foc Pekka antoi kirjan Merjalle	Adv-S-V-O-IO	.	.
22. Pekka kaski heidan kirjan antaa Merjalle	S-V-s-O-v-IO	?	?
39. Merjalle#foc kaski heidan Pekka antaa kirjan	IO-V-s-S-v-O	?	?
43. kirjan heittamalla Merjalle Pekka antoi	O-Adv-IO-S-V	?	?
64. heittamalla#foc Merjalle kirjan antoi Pekka	Adv-IO-O-V-S	?	?
89. Pekka heidan Merjalle kaski kirjan antaa	S-s-IO-V-O-v	?	?
23. kuorsaamalla Pekka Merjaa hairitsee	Adv-S-O-V	??	??
49. Pekka#foc kirjan heidan Merjalle kaski antaa	S-O-s-IO-V-v	??	??
79. Merjaa#foc heidan ihailla kaski Pekka	O-s-v-V-S	??	??
132. heidan Merjalle Pekka kirjan kaski antaa	s-IO-S-O-V-v	??	??
214. Merjalle kirjan Pekka antoi	IO-O-S-V	??	??
232. antaa#foc heidan Pekka Merjalle kaski kirjan	v-s-S-IO-V-O	?*	?*
273. heidan kirjan Merjalle antaa kaski Pekka	s-O-IO-v-V-S	?*	?*
630. antanut#foc kirjaa Pekka Merjalle ei	V-O-S-IO-n	?*	?*
705. heidan Merjaa ihailla Pekka kaski	s-O-v-S-V	?*	?*
710. Pekka kirjan Merjalle heidan kaski antaa S	-O-IO-s-V-v	?*	?*
2. kirjan#foc Pekka antaa Merjalle kaski heidan	O-S-v-IO-V-s	*	*
5. Pekka antaa kaski kirjan Merjalle heidan	S-v-V-O-IO-s	*	*
6. antaa kirjan kaski Merjalle Pekka heidan	v-O-V-IO-S-s	*	*
8. heidan#foc Pekka antaa Merjalle kaski kirjan	s-S-v-IO-V-O	*	*
9. Pekka#foc kirjan Merjalle kaski antaa heidan	S-O-IO-v-s	*	*

marginality

Symbols used

V = main verb	S = grammatical subject
O = direct object	IO = indirect object
Adv = adverbial	s = infinitival thematic subject
v = infinitival verb	n = negation (preverbal in canonical Finnish)
#foc = contrastive focus prosody	X = contrastively focused

PREDICTION ERROR

In a sample of 1,000 sentences taken from the whole corpus

Group	Explanation	Number	%
A	Grammatical sentences analyzed wrongly as ungrammatical	125	(12,5)
B	Ungrammatical sentences analyzed wrongly as grammatical	25	(2,5)
C	Wrong marginality estimation (adjacent categories)	44	(4,4)
D	Wrong marginality estimation (non-adjacent categories)	30	(3,0)
E	Wrong parsing output	0	(0,0)
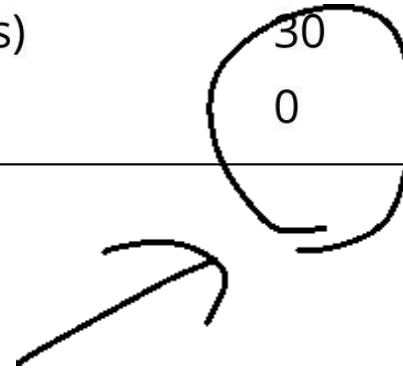
Output in English (argument cannot be floated like adjuncts)

John sleeps	S-V	*John to Mary the book gave	*S-IO-O-V
*sleeps John	*V-S	*Gave John the book to Mary	*V-S-O-IO
John likes Mary	S-V-O	*Gave John to Mary the book	*V S-IO-O
*John Mary likes	*S-O-V	*Gave the book tó Mary John	*V-O-IO-S
*Likes John Mary	*V-S-O	*Gave to Mary John the book	*V-IO-S-O
*Likes Mary John	*V-O-S	*The book John gave to Mary	*O-S-V-IO
*Mary John likes	*O-S-V	'*To Mary John gave the book	*IO-S-V-O
Mary likes John	S-V-O	*To Mary the book John gave	*IO-O-S-V
John gave the book to Mary	S-V-O-IO	*To Mary the book gave John	*IO-O-V-S
*John the book gave to Mary	*S-O-V-IO	Mary gave the book to John	S-V-O-IO
*John the book to Mary gave	*S-O-IO-V		
		[The book to John] gave Mary	S-V-O
		[The book to Mary] gave John	S-V-O

Same sentences in Finnish, most word orders correctly judged as grammatical and parsed correctly

1. Pekka nukkui (S-V)
2. *Nukkui Pekka (*V-S)
3. Pekka ihailee Merjaa (S-V-O)
4. (?)Pekka Merjaa ihailee (?S-O-V)
5. *Ihailee Pekka Merjaa (*V-S-O)
6. *Ihailee Merjaa Pekka (*V-O-S)
7. (?)Merjaa Pekka ihailee (?O-S-V)
8. Merjaa ihailee Pekka (O-V-S)
9. Pekka antoi kirjan Merjalle (S-V-O-IO)
10. Pekka antoi Merjalle kirjan (S-V-IO-O)
11. (?) Pekka kirjan antoi Merjalle (?S-O-V-IO)
12. ? Pekka kirjan Merjalle antoi (?S-O-IO-V)
13. (?) Pekka Merjalle antoi kirjan (?S-IO-V-O)
14. ? Pekka Merjalle kirjan antoi (?S-IO-O-V)
15. *Antoi Pekka kirjan Merjalle (*V-S-O-IO)
16. *Antoi Pekka Merjalle kirjan (*V-S-IO-O)
17. *Antoi kirjan Pekka Merjalle (*V-O-S-IO)
18. *Antoi kirjan Merjalle Pekka (*V-O-IO-S)
19. *Antoi Merjalle Pekka kirjan (*V-IO-S-O)
20. *Antoi Merjalle kirjan Pekka (*V-IO-O-S)
21. (?) Kirjan Pekka antoi Merjalle (?O-S-V-IO)
22. ? Kirjan Pekka Merjalle antoi (? O-S-IO-V)
23. Kirjan antoi Pekka Merjalle (O-V-S-IO)
24. Kirjan antoi Merjalle Pekka (O-V-IO-S)
25. ? Kirjan Merjalle Pekka antoi (?O-IO-S-V)
26. (?) Kirjan Merjalle antoi Pekka (?O-IO-V-S)
27. (?) Merjalle Pekka antoi kirjan (?IO-S-V-O)
28. ?? Merjalle Pekka kirjan antoi (??IO-S-O-V)
29. Merjalle antoi Pekka kirjan (IO-V-S-O)
30. Merjalle antoi kirjan Pekka (IO-V-O-S)
31. ?? Merjalle kirjan Pekka antoi (??IO-O-S-V)
32. (?) Merjalle kirjan antoi Pekka (?IO-O-V-S)

1. [‹ D Pekka › :1 [T/fin [‹ DP › :1 nukku]]] (0)
3. [‹ D Pekka › :1 [T/fin [‹ DP › :1 [v [ihailee [D Merjaa]]]]]](0)
4. [‹ D Pekka › :1 [‹ D Merjaa › :2 [T/fin [‹ DP › :1 [v [‹ DP › :2 ihailee]]]]]](0)
7. [‹ D Merjaa › :1 [‹ D Pekka › :2 [T/fin [‹ DP › :2 [v [‹ DP › :1 ihailee]]]]]](0)
8. [‹ D Merjaa › :1 [T/fin [‹ DP › :2 [v [‹ DP › :1 [ihailee ‹ D Pekka › :2]]]]]](0)
9. [‹ D Pekka › :1 [T/fin [‹ DP › :1 [v [antaa [[D kirja] ‹ P(lle) [D Merja-] ›]]]]]](0)
10. [‹ D Pekka › :1 [T/fin [‹ DP › :1 [v [[antaa [‹ P(lle) [D Merja-] › :2 [D kirja]]] ‹ PP › :2]]]]](0)
11. [‹ D Pekka › :1 [‹ D kirja › :2 [T/fin [‹ DP › :1 [v [‹ DP › :2 [antaa ‹ P(lle) [D Merja-] ›]]]]]]](0)
12. [‹ D Pekka › :1 [‹ D kirja › :2 [‹ P(lle) [D Merja-] › :3 [T/fin [‹ DP › :1 [v [[‹ DP › :2 antaa] ‹ PP › :3]]]]]]](1)
13. [‹ D Pekka › :1 [‹ P(lle) [D Merja-] › :2 [T/fin [‹ DP › :1 [v [[antaa [D kirja]] ‹ PP › :2]]]]]](0)
14. [‹ D Pekka › :1 [‹ P(lle) [D Merja-] › :2 [‹ D kirja › :3 [T/fin [‹ DP › :1 [v [‹ DP › :3 [antaa ‹ PP › :2]]]]]]](0)
21. [‹ D kirja › :1 [‹ D Pekka › :2 [T/fin [‹ DP › :2 [v [‹ DP › :1 [antaa ‹ P(lle) [D Merja-] ›]]]]]]](0)
22. [‹ D kirja › :1 [‹ D Pekka › :2 [‹ P(lle) [D Merja-] › :3 [T/fin [‹ DP › :2 [v [[‹ DP › :1 antaa] ‹ PP › :3]]]]]]](1)
23. [‹ D kirja › :1 [T/fin [‹ DP › :2 [v [‹ DP › :1 [antaa ‹ ‹ D Pekka › :2 ‹ P(lle) [D Merja-] › ›]]]]]](0)
24. [‹ D kirja › :1 [T/fin [‹ DP › :2 [v [‹ DP › :1 [antaa ‹ ‹ P(lle) [D Merja-]› ‹ D Pekka › :2 ›]]]]]](0)
25. [‹ D kirja › :1 [‹ P(lle) [D Merja-] › :2 [‹ D Pekka › :3 [T/fin [‹ DP › :3 [v [[‹ DP › :1 antaa] ‹ PP › :2]]]]]]](0)
26. [‹ D kirja › :1 [‹ P(lle) [D Merja-] › :2 [T/fin [‹ DP › :3 [v [[‹ DP › :1 [antaa ‹ D Pekka › :3]] ‹ PP › :2]]]]]
27. [‹ P(lle) [D Merja-] › :1 [‹ D Pekka › :2 [T/fin [‹ DP › :2 [v [[antaa [D kirja]] ‹ PP › :1]]]]]](0)
28. [‹ P(lle) [D Merja-] › :1 [‹ D Pekka › :2 [‹ D kirja › :3 [T/fin [‹ DP › :2 [v [‹ DP › :3 [antaa ‹ PP › :1]]]]]]]](2)
29. [‹ P(lle) [D Merja-] › :1 [T/fin [‹ DP › :2 [v [[antaa [‹ D Pekka › :2 [D kirja]]] ‹ PP › :1]]]]](0)
30. [‹ P(lle) [D Merja-] › :1 [T/fin [‹ DP › :2 [v [[antaa [[D kirja] ‹ D Pekka › :2]] ‹ PP › :1]]]]](0)
31. [‹ P(lle) [D Merja-] › :1 [‹ D kirja › :2 [‹ D Pekka › :3 [T/fin [‹ DP › :3 [v [‹ DP › :2 [antaa ‹ PP › :1]]]]]]]](2)
32. [‹ P(lle) [D Merja-] › :1 [‹ D kirja › :2 [T/fin [‹ DP › :3 [v [‹ DP › :2 [[antaa ‹ D Pekka › :3] ‹ PP › :1]]]]]]](0)

General conclusions

1. Finnish word order phenomenon can be explained by a minimalist top-down/parser-friendly theory of language comprehension (Phillips, 1996; Chesi 2004, …)
2. Also marginality can be predicted in a principled way, its not a mysterious free parameter
3. We propose that
   1. In free word languages, thematic arguments can be attached to the phrase structure syntactically as adjuncts/adverbs; in fixed word order languages (English, Italian), this is not possible
   2. The extra adjunct floating operation is licensed by rich morphosyntax, so that both morphosyntax and order encode hierarchy
   3. Marginality is explained (in part) by the "unnaturalness" of the input in language comprehension

Thank you!

Special thanks to Jukka Purma for helping with programming

Specific issues related to Finnish syntax

List of seed sentences used in the experiment

Group 1. Declarative clauses

Pekka nukkui

'Pekka slept.'

Pekka ihailee Merjaa

'Pekka admires Merjaa.'

Pekka antoi kirjan Merjalle

'Pekka gave a book to Merja.'

Group 2. Negative clauses

Pekka ei nukkunut

'Pekka did not sleep.'

Pekka ei ihaile Merjaa

'Pekka does not admire Merja.'

Pekka ei antanut kirjaa Merjalle

'Pekka did not give the book to Merja.'

Group 3. Embedded infinitivals

Pekka käski heidan nukkua

'Pekka asked them to sleep.'

Pekka käski heidan ihailla Merjaa

'Pekka asked them to admire Merja.'

Pekka käski heidan antaa kirjan Merjalle

'Pekka asked them to give the book to Merja.'

Group 4. Adverbial

Pekka nukkui kuorsaamalla

'Pekka slept while snoring.'

Pekka häiritsee Merjaa kuorsaamalla

'Pekka disturps Merja by snoring.'

Pekka antoi kirjan Merjalle heittämallä

'Pekka gave the book to Merja by throwing.'

Group 5. Negation and adverbial

Pekka ei nukkunut kuorsaamalla

'Pekka did not sleep (by) snowing.'

Pekka ei häiritse Merjaa kuorsaamalla

'Pekka does not disturb Merja by snoring.'

Pekka ei antanut kirjaa Merjalle heittämallä

'Pekka did not give the book to Merja by throwing.'

Grouop 6. Negated infinitival embedding

Pekka ei käskenyt heidan nukkua

'Pekka did not ask them to sleep.'

Pekka ei käskenyt heidän ihailla Merjaa

'Pekka did not ask them to admire Merja.'

Pekka ei käskenyt heidän antaa kirjaa Merjalle

'Pekka did not ask them to give the book to Merja.'

Group 7. Infinitival embedding with adverbial

Pekka käski heidän nukkua kuorsaamalla

'Pekka asked them to sleep (by) snoring.'

Pekka käski heidän hairita Merjaa kuorsaamalla

'Pekka asked them to disturb Merja by snoring.'

Pekka käski heidän antaa kirjan Merjalle heittamalla

'Pekka asked them to give the book to Merja by throwing.'

Group 8. Negated infinitival embedding with adverbial

Pekka ei käskenyt heidän nukkua kuorsaamalla

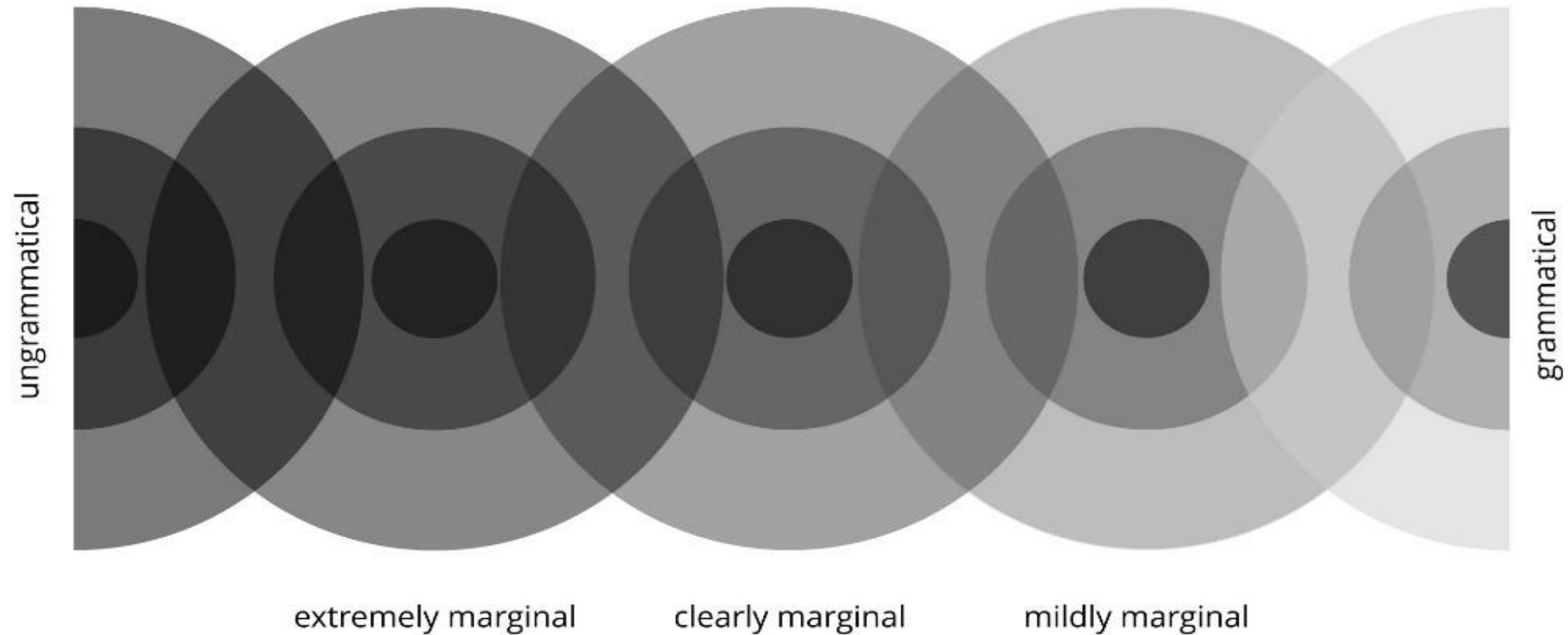'Pekka did not ask them to sleep by snoring.'

Pekka ei käskenyt heidän hairita Merjaa kuorsaamalla

'Pekka did not ask them to disturb Merja by snoring.'

Pekka ei käskenyt heidän antaa kirjaa Merjalle heittamällä

'Pekka did not ask them to give the book to Merja by throwing.'

Grammaticality/marginality judgments were based on the prototype model

Empirical phenomena covered in the model

A LINGUISTIC MAP TO THE MAIN CORPUS RESULT FILE

Phenomenon	Location(s) in the output (#)
Ban on verb-initial clauses/EPP	3/4, 9/10, 29/30
SVO vs OVS order	17/45
Multitopic constructions	21-27, 113
Multiple topics over Neg	157, 158, 161, 163, 169
T-to-C movement	32, 70, 92, 98, 174
Nonlocal head movement to C	74, 76, 102, 106
Nonlocal head movement and OVS inversion	112
"Null head movement"	121-124, 137-148, 391-292
Multiple infinitival (-fin) topics	131
Topicalized infinitival phrase	225, 229, 245, 400, 431, 541
Limited movement of genitives	366-368, 373-378, 437-448
Parsing of an adverbial	2093, 2095, 2101, 2105, 2107, 2111, 2113, 2141 2149, 2153-2392
Examples of extremely unnatural orders	225, 303, 325, 543, 717, 727, 811, 812, 839,1957

The mysterious property of null head movement

- The experiment revealed that I systematically accept sentences in which (it looks) a head has moved to an invisible/ unmarked/ mysterious "null head"

- ?*Pekka antanut₁ ei ___₁   kirjaa Merjalle.
  Pekka give   not   book to.Merja
        ?   neg/Fin

- The model was not able to do this, hence it classified this type of sentences (wrongly) as ungrammatical (Category A prediction errors). It would be disastrous if we allow the model to reconstruct "null movement".

- I have no idea of what's going on here

Floating of genitive arguments

- To get the correct output, it had to be assumed that all other arguments except those that had the genitive Case could be floated; genitive arguments were treated like the frozen arguments in English
  - Pekka antoi *heidän* lähteä.
    Pekka let   they.gen to.leave
    'Pekka let them leave..'
  - *Pekka antoi __ lähteä *heidän*.
    Pekka let   to.leave they.gen

I found a systematic class of sentences of which I cannot determine if they are extremely marginal or ungrammatical. I suspect that there are two types of ungrammaticality, based on "violation of a grammatical principle" and "extremely unnatural"

- *Merjalle heittamalla kirjaa heidan antaa Pekka ei kaskenyt (IO-Adv-O-s-v-S-n-V); Pekka heidan ei kirjaa antaa heittamalla kaskenyt Merjalle (S-s-n-O-v-Adv-V-IO); Pekka kaski antaa heittamalla kirjan heidan Merjalle (S-V-v-Adv-O-s-IO); antaa#foc Merjalle Pekka heidan ei kirjaa heittamalla kaskenyt (V-IO-S-s-n-O-Adv-V); ei#foc Merjalle heittamalla antaa heidan Pekka kirjaa kaskenyt (n-IO-Adv-v-s-S-O-V); ei#foc Pekka kaskenyt antaa Merjalle heidan heittamalla kirjaa (n-S-V-v-IO-s-Adv-O); hairita#foc kaskenyt Pekka heidan Merjaa ei kuorsaamalla (v-V-S-s-O-n-Adv); heidan#foc Pekka kirjan antaa heittamalla kaski Merjalle (s-S-O-v-Adv-V-IO); heidan#foc heittamalla antaa kirjan Merjalle Pekka kaski (s-Adv-v-O-IO-s-V); heittamalla ei kaskenyt kirjaa Merjalle Pekka heidan antaa (Adv-n-V-O-IO-S-s-v); heittamalla heidan ei kaskenyt kirjaa Merjalle antaa Pekka (Adv-s-n-V-O-IO-v-S); heittamalla kirjaa ei kaskenyt Merjalle heidan Pekka antaa (Adv-O-n-V-IO-s-S-v); kaskenyt#foc heidan ei kuorsaamalla Pekka Merjaa hairita (V-s-n-Adv-S-O-v); kirjaa ei heidan antaa Merjalle Pekka kaskenyt heittamalla (O-n-s-v-IO-S-V-Adv); kirjaa#foc antaa Merjalle heidan heittamalla Pekka ei kaskenyt (O-v-IO-s-Adv-S-n-V); kuorsaamalla#foc heidan Pekka kaskenyt Merjaa ei hairita (Adv-s-S-V-O-n-v).*

Class B prediction error consisted of sentences in which the parser was "too good" in comparision to the human gold standard

- There were two types of sentences:
  - A. Nonlocal head movement, trivial for the model but not for me!
    - *KÄSKENYT kirjaa Pekka ei __ Merjalle heittamalla heidän antaa.*
      OREDERD book.par Pekka.nom not __ to.Merja by-throwing them to.give
  - B. Too many topics/preverbal phrases, trivial for the model but not for me!
    - *Kirjan Merjalle heittämällä heidän antaa Pekka käski*
      book to.Merja by.throwing they.gen to.give Pekka.nom ordered