HLP Lab – Psycholinguistics and Syntactic Corpora

Today: *Extracting and importing data from syntactic corpora into a database*

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Today

- Get your feet wet:
  - What is a **syntactically-annotated corpus**?
  - **TGrep2** :: a tool to search syntactically-annotated corpora
- Next week:
  - **TDT*lite*** :: a set of scripts we wrote to combine TGrep2 output into a database that can be handed to Excel or a stats program of your choice (e.g. R).

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  - avoid over-exclusive (hard)
  - cost-accuracy-tradeoff (less clean-up → noisier data)
- Extraction of variables of interest:
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that-omission

- Non-subject-extracted relative clauses in English allow optional *that*-omission:

How big is the family { ***you*** *cook for?* / ***that*** ***you*** *cook* } *for?*

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TGrep2

- Search tools for syntactic corpora developed by Doug Rohde (2005)
  - Downloadable for free: http://tedlab.mit.edu/~dr/Tgrep2/
  - Online tutorial: http://www.bcs.rochester.edu/people/fjaeger/teaching/tutorials/TGrep2/LabSyntax-Tutorial.html

- Parsed Switchboard in Penn Treebank format
  - 800,000 word syntactically annotated telephone **conversation** corpus (Switchboard, Treebank III)

A common syntactic annotation standard

- Syntactic structure annotation
  - Hierarchical dependencies
  - Linear order
  - Traces
  - Syntactic categories
- Predicate argument structure annotation
  - Grammatical functions (e.g. SUBJ, TOP, ADV, …)
  - Modification types (e.g. NP-TEMP, ADV-LOC, …)
  - Case marking preposition (e.g. PP-DTV)
- Part-of-speech (POS) annotation
- In Switchboard: disfluency (reparandum, repair)
- Genre, speaker, etc. information

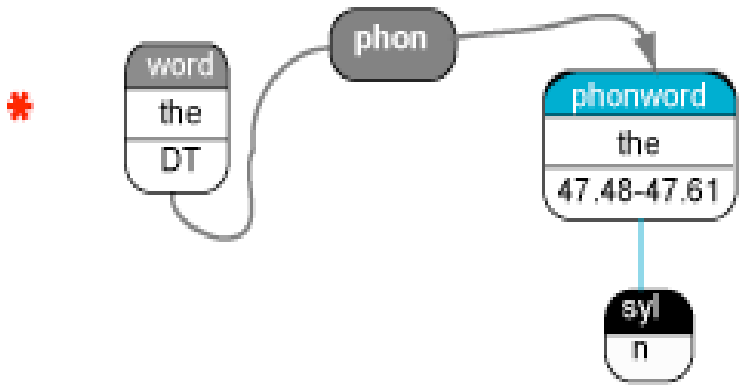
WSJ

```
(TOP (S (NP-SBJ (NP (NNP Pierre)
                    (NNP Vinken))
                (, ,)
                (ADJP (NP (CD 61)
                          (NNS years))
                      (JJ old))
                (, ,))
        (VP (MD will)
            (VP (VB join)
                (NP (DT the)
                    (NN board))
                (PP-CLR (IN as)
                        (NP (DT a)
                            (JJ nonexecutive)
                            (NN director)))
                (NP-TMP (NNP Nov.)
                        (CD 29))))
        (. .)))
(TOP (S (NP-SBJ (NNP Mr.)
                (NNP Vinken))
        (VP (VBZ is)
            (NP-PRD (NP (NN chairman))
                    (PP (IN of)
                        (NP (NP (NNP Elsevier)
                                (NNP N.V.)) …
```

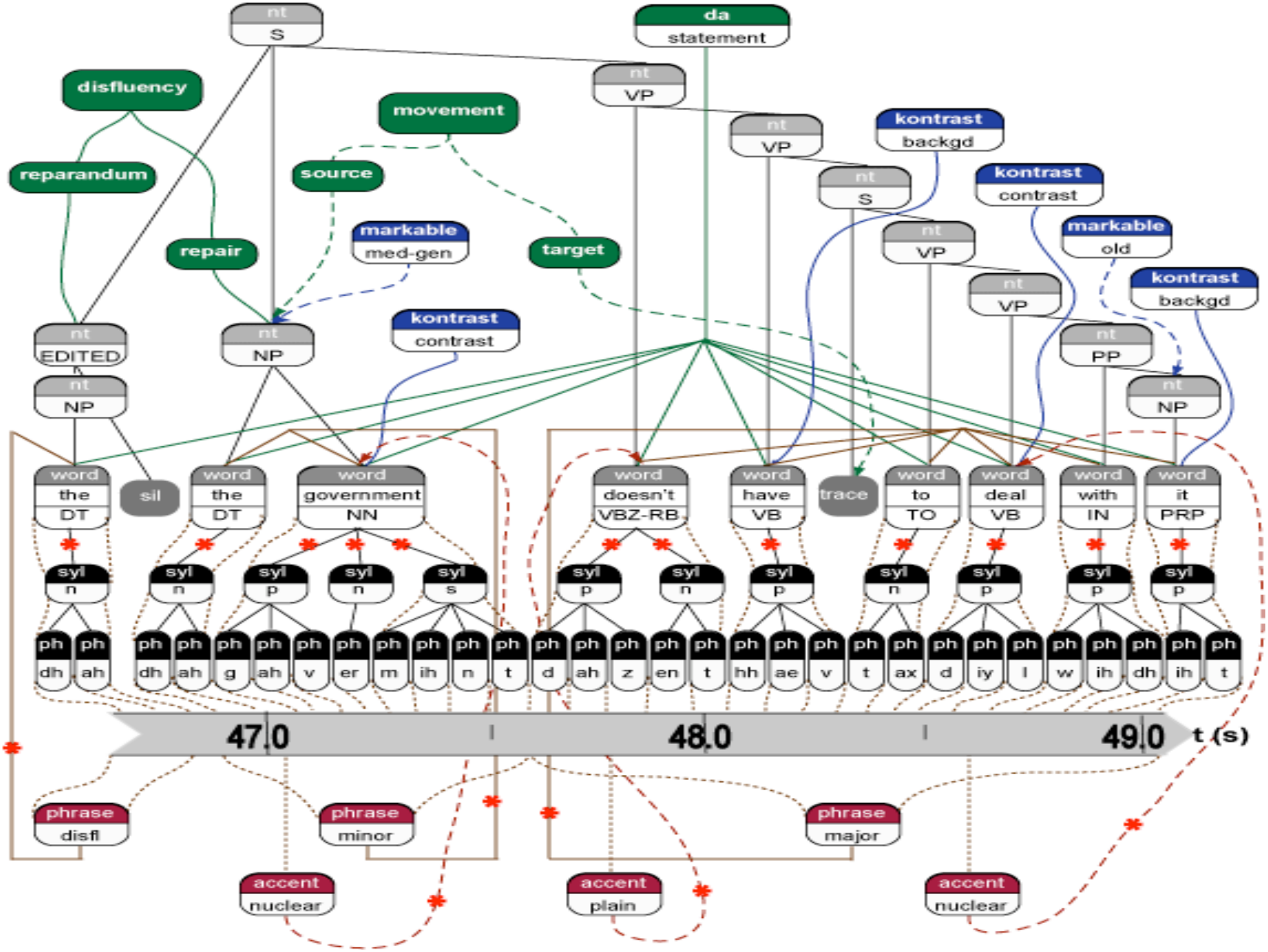
SWBD

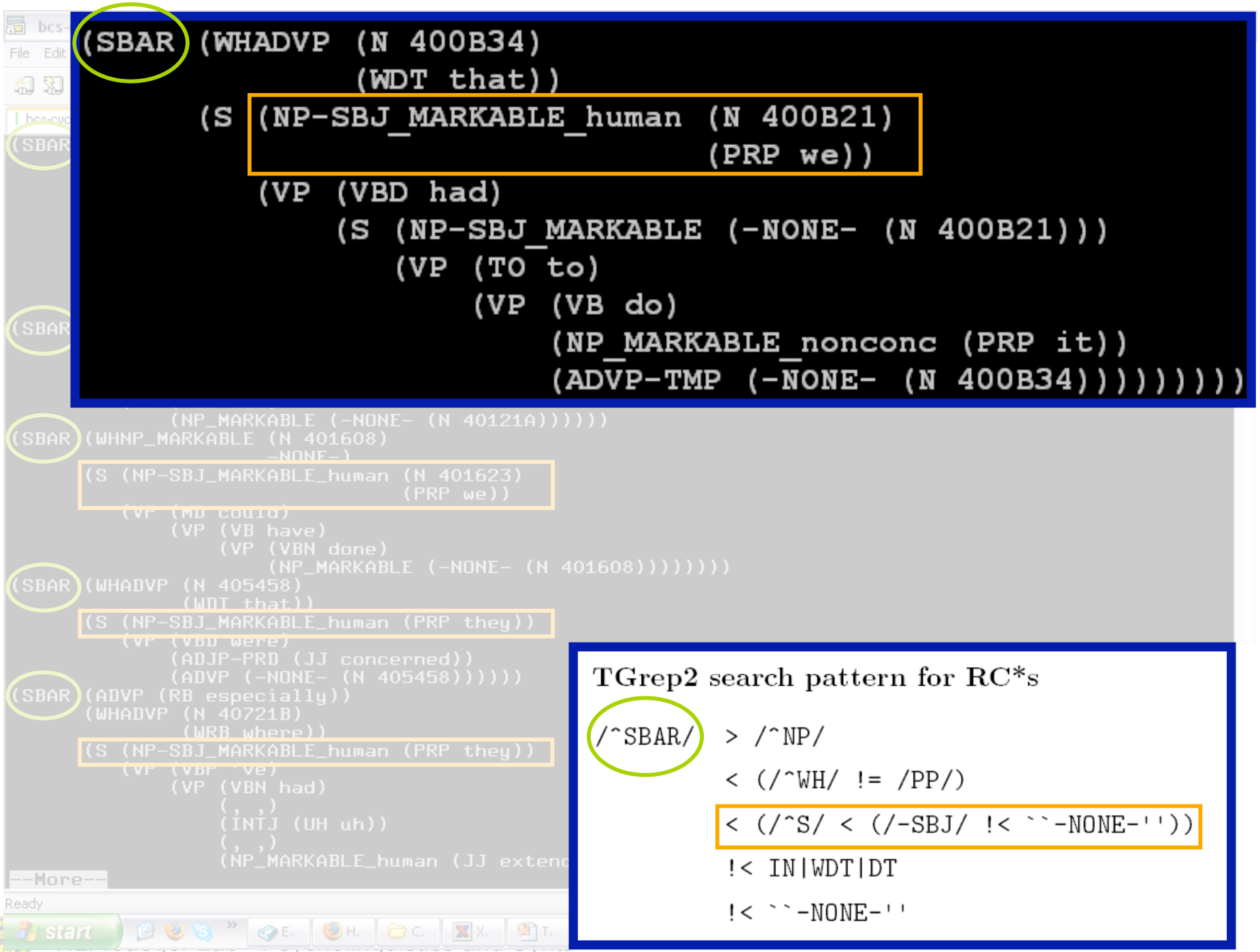
```
(TOP (CODE (SYM SpeakerA1)
           (. .)))
(TOP (INTJ (UH Okay)
           (. .)
           (-DFL- E_S)))
(TOP (S (INTJ (UH Uh))
        (, ,)
        (ADVP-TMP (RB first))
        (, ,)
        (INTJ (UH um))
        (, ,)
        (NP-SBJ-1 (PRP I))
        (VP (VBP need)
            (S (NP-SBJ (-NONE- *-1))
               (VP (TO to)
                   (VP (VB know)
                       (, ,)
                       (INTJ (UH uh))
                       (, ,)
                       (SBARQ (WHADVP-2 (WRB how))
                              (SQ (VBP do)
                                  (NP-SBJ (PRP you))
                                  (VP (VB feel)
                                      (ADVP (-NONE- *T*-2))
                                      (EDITED (RM (-DFL- \[))
                                              (PP-UNF (IN about))
```

Annotations in SWBD: NITE XML



- Combination of annotations from different projects in one big data structure
- Nodes can
  - have children (hierarchical relationship)
  - point at other nodes (arbitrary relationship)
- Some nodes have timing information from original sound files


nt S
da statement
disfluency
nt VP
movement
nt VP
kontrast backgd
reparandum
source
nt S
kontrast contrast
markable med-gen
nt VP
markable old
repair
target
nt VP
kontrast backgd
kontrast contrast
nt EDITED
nt NP
nt PP
nt NP
nt NP
word the DT
sil
word the DT
word government NN
word doesn't VBZ-RB
word have VB
trace
word to TO
word deal VB
word with IN
word it PRP
syl n
syl n
syl p
syl n
syl s
syl p
syl n
syl p
syl n
syl p
syl p
syl p
ph dh
ph ah
ph dh
ph ah
ph g
ph ah
ph v
ph er
ph m
ph ih
ph n
ph t
ph d
ph ah
ph z
ph en
ph t
ph hh
ph ae
ph v
ph t
ph ax
ph d
ph iy
ph l
ph w
ph ih
ph dh
ph ih
ph t
47.0
48.0
49.0
t (s)
phrase disfl
phrase minor
phrase major
accent nuclear
accent plain
accent nuclear


(SBAR (WHADVP (N 400B34)
(WDT that))
(S (NP-SBJ_MARKABLE_human (N 400B21)
(PRP we))
(VP (VBD had)
(S (NP-SBJ_MARKABLE (-NONE- (N 400B21)))
(VP (TO to)
(VP (VB do)
(NP_MARKABLE_nonconc (PRP it))
(ADVP-TMP (-NONE- (N 400B34)))))))))
(NP_MARKABLE (-NONE- (N 40121A))))))
(SBAR (WHNP_MARKABLE (N 401608)
-NONE-)
(S (NP-SBJ_MARKABLE_human (N 401623)
(PRP we))
(VP (MD could)
(VP (VB have)
(VP (VBN done)
(NP_MARKABLE (-NONE- (N 401608)))))))))
(SBAR (WHADVP (N 405458)
(WDT that))
(S (NP-SBJ_MARKABLE_human (PRP they))
(VP (VBD were)
(ADJP-PRD (JJ concerned))
(ADVP (-NONE- (N 405458))))))
(SBAR (ADVP (RB especially))
(WHADVP (N 40721B)
(WRB where))
(S (NP-SBJ_MARKABLE_human (PRP they))
(VP (VBP 've)
(VP (VBN had)
(, ,)
(INTJ (UH uh))
(, ,)
(NP_MARKABLE_human (JJ extend
--More--
Ready
start
TGrep2 search pattern for RC*s
/^SBAR/
> /^NP/
< (/^WH/ != /PP/)
< (/^S/ < (/-SBJ/ !< ``-NONE-''))
!< IN|WDT|DT
!< ``-NONE-''

Data

- Over 3,700 RC*s (RCs with obligatory *that* were excluded) from approximately 350 different speakers

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- Extracting all RC*s with a pronoun subject:

```
tgrep2 -af -m "%xm\n" "/^SBAR/ > /^NP/ < (/^WH/ != /PP/) <
   (/^S/ < (/-SBJ/ < /^PRP/)) !< IN|WDT|DT !< `-NONE-'"
```

outputs:

```
5:73
21:68
31:28
41:25
236:62
331:168
589:30
651:9
...
```

Variables in the model

- Use a set of scripts (**TGrep2 Database Tools**) to combine the output of many TGrep2 searches into a database of cases.

- **Probabilities:**
  - **RC Predictability; Predictability of RC onset**
  - Frequency of words immediately preceding and following RC onset

Variables in the model

- Continuous syntactic variables, e.g.
  - Lengths of each of 3 regions (pre-NP, between head noun and RC, & RC)
- Categorical structural variables, e.g.
  - Embedding within the RC
  - Properties of RC subject (NP type, animacy)
  - Properties of matrix clause (negation, verb)
- Structural priming, e.g.
  - Within speakers
  - Across speakers
  - Distance-based; Lemma-based; etc …

Variables in the RC* model

- Phonological variables, e.g.
  - segmental properties of preceding segment
  - stress structure of preceding segment
- Speech variables, e.g.
  - Speech rate, Pauses
  - Rate of disfluency in different regions
  - (Prosodic phrases & accents)
- Social variables, e.g.
  - Age
  - Speaker gender
  - Education

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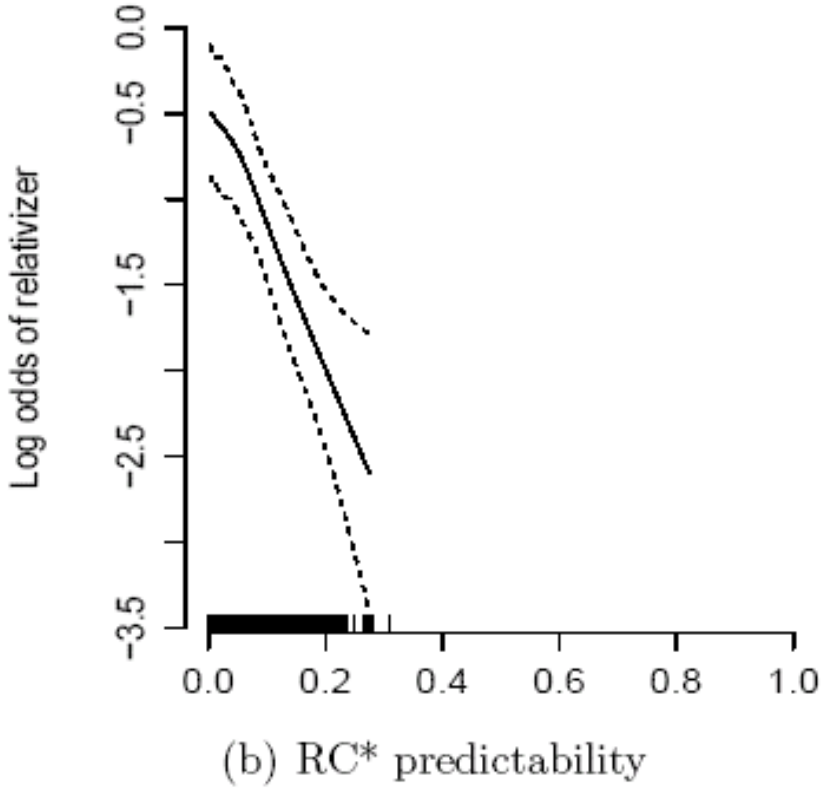
Results of model

- Predictability one of the most influential factors
  - Both RC* predictability and the predictability of the RC* onset affect *that*-rates *even when many other factors are considered*



(b) RC* predictability

- As predicted by Uniform Information Density

Contemporary American English with Penn Treebank III annotation – Text

- Parts of ATIS-3
- Parsed Brown corpus, release 3
  - approx. 24,000 sentences & 396,000 words
  - 15 different written text categories of (good standard reference; like BNC).
- Parts of Wall Street Journal corpus (WSJ), release 3
  - approx. 24k sentences & 505,000 words [1 million out of 30 million]
  - Newspaper articles
  - Also available:
    - RST discourse annotation (for parts)
    - Propositional/event structure annotation (113,000 verb tokens; 3,200 verb types)
    - Automatically annotated extension to 30 million words

Contemporary American English with Penn Treebank III annotation – Speech

- International Corpus of English (ICE-GB)
  - approx. 84,000 sentences & 1 million words
  - Speech and written language
  - Not quite Treebank III annotation style
- Parts of Switchboard corpus (Swbd), release 3
  - approx. 100k sentences & 800,000 words [1 million out of 2 million]
  - Spontaneous speech
  - Also available:
    - Disfluency annotation (all)
    - Sound files (all)
    - Phonetic & phonological annotation (~38,000 words)
    - Animacy annotation (~140,000 NPs)
    - Information Structure annotation (~60,000 NPs)

Diachronic American English with Penn Treebank III annotation

- The York-Toronto-Helsinki Parsed Corpus of Old English Prose (YCOE)
  - approx. 110,000 sentences & 1.5 million words
  - Also available:
    - Text source, genre, dialect, and publication date information

- Helsinki Parsed Corpus of Middle English, second edition (PPCME2)
  - Over 100,000 sentences & 1.3 million words
  - Prose text samples of Middle English
  - Also available:
    - Text source, genre, dialect, and publication date information

POS & Syntactically annotated corpora of other languages - (1)

- Parsed NEGRA corpus, version 2
  - German
  - approx. 200,000 sentences
  - Newspaper articles (Frankfurter Rundschau)
  - Also available:
    - Morphological analysis (first 60,000 words)
- Parsed TIGER corpus
  - German
  - approx. 40,000 sentences & 700,000 words
  - same source as NEGRA
- Prague Dependency Treebank, version 1.0
  - Czech
  - approx. 1.8 million words

POS & Syntactically annotated corpora of other languages - (2)

- Penn Chinese Treebank, version 6
  - approx. 600,000 words
  - Newswire text

- Penn Arabic Treebank, Part 3, version 1.0
  - approx. 340,000 words
  - Newswire text
  - Also available:
    - Vocalization and Lemmatization information
    - Aligned translations into English (for parts)

- Penn Korean Treebank,
  - approx. 5,000 sentence & 55,000 words
  - 33 constructed texts in Korean (translated into English) for purposes of language training in a military setting.

Let's do some practice

- Login to/login into/log into the corpus server

  ssh <username>@slate.hlp.rochester.edu

Sanity check

- Type *env* (and press enter):

  TGREP2_CORPUS=/p/hlp/corpora/TGrep2able/swbd.t2c.gz
  TGREP2ABLE=/p/hlp/corpora/TGrep2able/

  TDTlite=/p/hlp/tools/TDTlite/
  TDT_DATABASES=/p/hlp/tools/TDT/databases/

  PATH=...:/p/hlp/tools/TDTlite

TGrep2

- Type *tgrep2*

- *tgrep2 -c* <corpus> *-af* <output-options|output-formating> <macro-file> <pattern|pattern-file>

  -*c* <corpus> defaults to TGREP2_CORPUS
  -*af* gives all matches exactly once
  -*i* makes TGrep2 case-insensitive (default is case-sensitive)

  <output-options> and <macro-file> are optional

TGrep2

- … a very simple call: let's find sentences in the default corpus (Switchboard)

  tgrep2 "TOP" | more

  [*more* gives output page-by-page – press ENTER or SPACE]

TGrep2

- let's find NPs

  tgrep2 "NP" | more

- Now let's **count**:

  tgrep2 "NP" | wc -l

  [*wc -l* counts lines of the output; TGrep2 *defaults* to one match per line]

TGrep2 – Different outputs

- We can format the output:

  tgrep2 -l “NP” | more

  tgrep2 -t “NP” | more

  tgrep2 -u “NP” | more

  [be cautious with the *tgrep2 –l* | *wc -l*]

- There are more options for later …

TGrep2 – Regular Expressions

- Let's count *all* instances of *any type of* NP in the corpus:

  tgrep2 -af "NP" | wc –l

  tgrep2 -af "/^NP/" | wc -l

- Investigate why there is a difference:

  tgrep2 -af "/^NP/" | more

Across Corpora

- Count all instances of any type of NP in the **Wall Street Journal, Brown, and Switchboard corpus**

  ls $TGREP2ABLE

  brown.t2c.gz
  wsj_mrg.t2c.gz
  swbd.t2c.gz

  tgrep2 -c $TGREP2ABLE/<corpus-file> -af “/^NP/” | wc -l

- **What’s the ration of NPs (/^NP) to VPs (/^VP/) in the three corpora?**

How many of these NPs have lexical content (as opposed to traces)?

tgrep2 -af "/^NP/ << (/^'{0,1}[a-zA-Z].*/ @< *)" | wc –l

- NB:
  - Left-headedness

Time to get real: PP-ordering in English

(Hawkins, 1999; taken from Hawkins, 2007:97)

(19) a. The man vp[waited pp1[for his son] pp2[in the cold but not unpleasant wind]]
1 2 3 4 5
---

b. The man vp[waited pp2[in the cold but not unpleasant wind] pp1[for his son]]
1 2 3 4 5 6 7 8 9

Structures like (19) were selected from a corpus on the basis of a permutation test (Hawkins, 2000, 2001): the two **PP**s had to be permutable with truth-conditional equivalence (i.e. the speaker had a choice). Only 15% (58/394) of these English sequences had long before short. Among those with at least a one-word weight difference (excluding 71 with equal weight), 82% had short before long, and there was a gradual reduction in the long before short orders, the bigger the weight difference (**PPS** = shorter **PP**, **PPL** = longer **PP**):

(22)	PPL > PPS by 1 word	by 2 4	by 5 6	by 7+
[V PPS PPL]	60% (58)	86% (108)	94% (31)	99% (68)
[V PPL PPS]	40% (38)	14% (17)	6% (2)	1% (1)

Time to get real …

- What should be the cases we extract to get **all and only** the relevant cases? (avoid inclusion and exclusion errors)

- VPs
- VPs with PPs
- VPs with PPs that are sisters to each other
- VPs with adjacent PPs that are sisters to each other
- VPs with exactly two adjacent PPs that are sisters to each other

Cheat sheet

- **TGrep2 is left-headed!**
- Syntactic relations: < > << >> $ ~ =
- Linear relations: , .
- Labeling of nodes: =xx
- Disjunction | []
- Negation: !

```
/^VP/=VP1 < (/^PP/=PP1
                $.. (/^PP/=PP2  !$ (/^PP/ != =PP1)
                                !,, (* !< * ,, =PP1
                                        !>> (EDITED|UH|PRN|/-
    UNF/
                                                >> =VP1))))
```

Macros

- Macros keep those precious fingers soft and smooth by avoiding to much typing

```
@ NP              /^NP/;
@ VP              /^VP/;
@ PP              /^PP/;
@ AP              /^(ADJ|ADV)P/;
@ WH              /^WH/;
@ SBJ_ZERO        (@SBJ) < (@ZERO);
@ SBJ_NERO        (@SBJ) !< (@ZERO);
@ SSBJ_ZERO       S < (@SBJ_ZERO);
@ SSBJ_NERO       S < (@SBJ_NERO);
```