# Computational Intelligence 696i 

Language

Homework 1 Answers Sandiway Fong

## Homework 1

- answers are provided here for Questions 1 and 2 only on Homework 1


## Homework 1

- Minimal Pair:
- (1) a. John is too stubborn to talk to
- b. John is too stubborn to talk to Bill
- It's an interesting example:
- just adding one word Bill provokes a big change in gap-filling
- PAPPI parses:
- (2) a. John[1] is too stubborn Op[1] PRO[2] to talk to t[1]
- b. John[1] is too stubborn PRO[1] to talk to Bill[2]
- Readings:
- (3) a. John is too stubborn for some arbitrary person to talk to John
- b. John is too stubborn for John to talk to Bill


## Homework 1

- Question 1: 2pts (giveaway)
- how many structures did it consider for each sentence?
- Question 2: (6pts)
- Consider the sentence:
- (4) John is too stubborn [for John] to talk to himself
- PAPPI parses both versions of this sentence
- why is this interpretation unavailable for (1a)?
- what principle(s) rules it out?
- your answer should report which parse numbers and the steps required to drill down to the answer


## Question 1

- Question 1: 2pts (giveaway)
- how many structures did it consider for each sentence?
- Discussion:
- depends on what you count as a (distinct) structure: an acceptable answer is the fan-out after chain formation, i.e. parser operation Trace Theory
- a more complete answer would also include the extra fan-out generated by parser operations Free Indexation and LF Movement
- Answers: (based at Trace Theory)
- (1) a. John is too stubborn to talk to 94
- b. John is too stubborn to talk to Bill 33

|  | Generators |
| :---: | :---: |
|  | Parse PF |
|  | Parse 5-structure |
|  | Assign Theta-Roles |
|  | Inherent Case Assignment |
|  | Assign structural Case |
|  | Trace Theory |
|  | Functional Determination |
|  | Free indexation |
|  | Expletive Linking |
|  | LF Movement |

(1a)

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Generators
Parse PF
Parse s-structure Assign Theta-Roles Inherent Case Assignment Assign structural Case Trace Theory Trace Theory Functional Determination Free Indexation Expletive Linking LF Movement
```


## Question 2

- Question 2: (6pts)
- Consider the sentence:
- (4) John is too stubborn [for John] to talk to himself
- PAPPI parses both versions of this sentence
- why is this interpretation unavailable for (1a)?
- Discussion:
- (1) a. John is too stubborn to talk to
- in the case of (1a), we are looking for structures generated by PAPPI matching the general template (5)
- (5) John[1] is too stubborn NP[1] to talk to NP[1]
- where NP denotes some empty noun phrase (NP)
- recall PAPPI tries all possible structures, so there may be multiple attempts at getting something matching (5) through the gauntlet of constraints
- from the answer to Question 1, there are 94 structures generated by parser operation Trace Theory
- first question to ask is: which of these match the general template in (5) ?


## Question 2

- Discussion:
- PAPPI emits 4 different basic structures out of parser operation Parse S-structure
- Parsing: john is too stubborn to talk to
- Exit Parse S-Structure: (1)
- [C2[C][I2[NP john]1 [11[1(AGR)[I(AGR)]1 [V is]2 11 [VP[Vt]2 [AP[AP[ADV too][A stubborn]][C2[C][I2[NP]3 [11[It]3 [VP[VP[V talk]4 [I]3 ][PP[P to][NP] $]$ ] $]$ ] $]$ ]
- this one is like the correct parse except there is no empty operator (Op) position in Spec-CP
- Exit Parse S-Structure: (2)
- [C2[C][I2[NP john]1 [11[I(AGR)[I(AGR)]1 [V is]2 ]1 [VP[Vt]2 [AP[AP[ADV too][A stubborn]][C2[NP][C1[C][12[NP]3 [11[tt]3 [VP[VP[V talk]4[1]3 ][PP[P to][NP [N] $]$ ]
- this one generates the correct parse, [NP] in [C2[NP].. gets resolved as an empty operator (Op)


## Question 2

- Discussion:
- PAPPI emits 4 different basic structures out of parser operation Parse Sstructure
- Exit Parse S-Structure: (3)
- [C2[NP john][C1[C][I2[NP]1 [I1[I(AGR)[I(AGR)]1 [V is]2 ]1 [VP[Vt]2 [AP[AP[ADV too][A stubborn]][C2[C][I2[NP]3 [11[It]3 [VP[VP[V talk]4 [I]3 ][PP[P to][NP]]]]]]]]]]]]
- Exit Parse S-Structure: (4)
- [C2[NP john][C1[C][I2[NP]1 [I1[I(AGR)[I(AGR)]1 [V is]2 ]1 [VP[Vt]2 [AP[AP[ADV too][A stubborn]][C2[NP][C1[C][I2[NP]3 [I1[It]3 [VP[VP[V talk]4 [I]3 ][PP[P to][NP[][נ]נ[נ]נ[נ]נ]נ]
- both (3) and (4) have the noun phrase (NP) subject John in the wrong place [C2[NP john]... not the subject position [i2[NP]1...
- these four structures partition the 94 structures emitted by parser operation Trace Theory as follows:
- (1) 1-7, (2) 8-21, (3) 22-34, (4) 35-94
- there are 17 matching structures (direct and indirect in a sense to be made clear) partitioned as follows:
- (1) 2 direct, 1 indirect, (2) 4 direct, 1 indirect, (3) none, (4) 6 direct, 3 indirect


## Question 2

- Answer: 17 out of 94 structures match

| Trace <br> Theory <br> Structure \# | Inherent Case <br> Assignment | Theta Criterion | D-structure <br> Theta <br> Condition | Case Filter | Case Condition on ECs | Condition B | ECP | $\begin{aligned} & \text { ECP } \\ & \text { at } \\ & \text { LF } \end{aligned}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 2 |  | X | X |  | X |  | x | X |
| 4 |  | X | X |  |  | X | X | X |
| 5 | X | X | X |  |  |  | X | X |
| 11 |  | X | X |  |  |  | X | X |
| 14 |  | X | X |  | X |  |  |  |
| 16 |  | X | X |  | X | X |  |  |
| 17 | X | X | X |  | X |  |  | X |
| 20 | X | X | X |  | X |  | x | X |
| 39 |  | X | X |  | X | X | X | X |
| 42 |  | X | X | X | X |  | X | X |
| 52 |  | X | X |  | X |  | X | X |
| 59 |  | X | X |  |  | X | X | X |
| 62 | X | X | X | X | X |  | X | X |
| 72 | X | X | X |  |  |  | X | X |
| 85 |  | X | X | X | X | X | X | X |
| 88 | X | X | X | X | X |  | X | X |
| 93 | X | X | X | X | X |  | X | X |

## Question 2

- Answer: 17 out of 94 structures match
- Discussion:
- preceding table shows the principles that block each of the structures referenced by the Trace Theory parser operation exit numbers
- all of the structures violate Theta Theory
- Theta Criterion, D-structure Theta Condition
- most of them also violate the Empty Category Principle (ECP)
- either at S-structure or LF (or both)
- some of them also violate elements of Case Theory
- Inherent Case Assignment, Case Filter, Case Condition on Traces


## Question 2

- Answer: 17 out of 94 structures match
- Discussion:
- to prevent interpretation (5) from being available,
- PAPPI has to rule out every one of these 17 structures
- recall the arrow/target analogy $\Rightarrow \rightarrow$
- Theta Theory is the blocking module
- out of the 17 structures
- 12 already have the required indexing after parser operation Trace Theory
- 5 more (indirect - indicated by the yellow rows in the
 table) are partially indexed after Trace Theory, picking up a needed index only after parser operation Free Indexation
- see Question 1 discussion of Free Indexation


## Question 2

- Discussion:
- Example: (of partial indexing)
- Exit Trace Theory: (16)
- [C2[C][I2[NP john]1 [11[I(AGR)[I(AGR)]1 [V is]2 ]1 [VP[Vt]2 [AP[AP[ADV too][A stubborn]][C2[NPt]1 [C1[C][[L2[NPt]1 [11[It]1

- NP (shown in bold) is not yet assigned an index
- Exit Free Indexation: (1)
- [C2[C][I2[NP john]1 [11[l(AGR)[I(AGR)]1 [V is]2 ]1 [VP[Vt]2 [AP[AP[ADV too)][A stubborn]][C2[NPt]1 [C1[C][[12[NPt]1 [11[It]1

- NP (shown in bold) is now co-indexed with John
- Exit Free Indexation: (2)
- [C2[C][L2[NP john]1 [11[l(AGR)[I(AGR)]1 [V is]2 ]1 [VP[Vt]2 [AP[AP[ADV too]]A stubborn]][C2[NPt]1 [C1[C][[2[NPt]1 [11[tt]1 [VP[VP[V talk]3 [I]1 ][PP[P to] [NP]4 ]] $]$ ]
- not the structure we want


## Question 2

- the 12 matching examples after Trace Theory are:
- (2) [C2[C][I2[NP john]1 [I1[I(AGR)[I(AGR)]1 [V is]2 ]1 [VP[Vt]2 [AP[AP[ADV too][A stubborn]][C2[C][I2[NPt]1 [I1[It]1 [VP[VP[V talk]3 [I]1 ][PP[P to][NPt]1 ]]] $]$ ] $]$ ] $]$ ]]
- (5) [C2[C][I2[NP john]1 [I1[I(AGR)[I(AGR)]1 [V is]2 $] 1$ [VP[Vt]2 [AP[AP[ADV too][A stubborn]][C2[C][I2[NPt]1 [I1[It]1 [VP[VP[V talk]3 [l]1 ][PP[P to][NPt]1 ]]]]]]]]]]]
- (11) [C2[C][I2[NP john]1 [11[l(AGR)[I(AGR)]1 [V is]2 ]1 [VP[Vt]2 [AP[AP[ADV too][A stubborn]][C2[NPt]1 [C1[C][I2[NPt]1 [11[It]1 [VP[VP[V talk]3 [I]1 ][PP[P to][NPt]1 ]]]]]]]]]]]]
- (14) [C2[C][I2[NP john]1 [11[l(AGR)[I(AGR)]1 [V is]2 ]1 [VP[Vt]2 [AP[AP[ADV too][A stubborn]][C2[NPt]1 [C1[C][I2[NPt]1 [I1[It]1 [VP[VP[V talk]3 [I]1 ][PP[P to][NPt]1 $]$ ] $]$ ] $]$ ] $]$ ] $]$ ]]


## Question 2

- the 12 matching examples after Trace Theory are:
- (17) [C2[C][I2[NP john]1 [11[I(AGR)[I(AGR)]1 [V is]2 ]1 [VP[Vt]2 [AP[AP[ADV too][A stubborn]][C2[NPt]1 [C1[C][I2[NPt]1 [I1[It]1 [VP[VP[V talk]3 [I]1 ][PP[P to][NPt]1 ]] $]$ ] $]$ ] $]$ ]נ]]
- (20) [C2[C][I2[NP john]1 [I1[I(AGR)[I(AGR)]1 [V is]2 ]1 [VP[Vt]2 [AP[AP[ADV too][A stubborn]][C2[NPt]1 [C1[C][I2[NPt]1 [I1[It]1 [VP[VP[V talk]3 [I]1 ][PP[P to][NPt]1 ]] $]$ ] $]$ ] $]$ ] $]$ ]]
- (42) [C2[NP john]1 [C1[C][I2[NPt]1 [11[I(AGR)[I(AGR)]1 [V is]2 ]1 [VP[Vt]2 [AP[AP[ADV too][A stubborn]][C2[NPt]1 [C1[C][I2[NPt]1

- (52) [C2[NP john]1 [C1[C][I2[NPt]1 [11[I(AGR)[I(AGR)]1 [V is]2 ]1 [VP[Vt]2 [AP[AP[ADV too][A stubborn]][C2[NPt]1 [C1[C][I2[NPt]1 [11[It]1 [VP[VP[V talk]3 [I]1 ][PP[P to][NPt]1 $]]][]]]]]]]]]$


## Question 2

- the 12 matching examples after Trace Theory are:
- (62) [C2[NP john]1 [C1[C][I2[NPt]1 [I1[I(AGR)[I(AGR)]1 [V is]2 ]1 [VP[Vt]2 [AP[AP[ADV too][A stubborn]][C2[NPt]1 [C1[C][I2[NPt]1

- (72) [C2[NP john]1 [C1[C][I2[NPt]1 [I1[I(AGR)[I(AGR)]1 [V is]2 ]1 [VP[Vt]2 [AP[AP[ADV too][A stubborn]][C2[NPt]1 [C1[C][I2[NPt]1

- (88) [C2[NP john]1 [C1[C][I2[NPt]1 [11[I(AGR)[I(AGR)]1 [V is]2 ]1 [VP[Vt]2 [AP[AP[ADV too][A stubborn]][C2[NPt]1 [C1[C][I2[NPt]1

- (93) [C2[NP john]1 [C1[C][I2[NPt]1 [11[I(AGR)[I(AGR)]1 [V is]2 ]1 [VP[Vt]2 [AP[AP[ADV too][A stubborn]][C2[NPt]1 [C1[C][I2[NPt]1



## Question 2

- the 5 other matching examples are:
- (4) [C2[C][I2[NP john]1 [I1[I(AGR)[I(AGR)]1 [V is]2 ]1 [VP[Vt]2 [AP[AP[ADV too][A stubborn]][C2[C][I2[NPt]1 [I1[It]1 [VP[VP[V

- (16) [C2[C][I2[NP john]1 [11[I(AGR)[I(AGR)]1 [V is]2 ]1 [VP[Vt]2 [AP[AP[ADV too][A stubborn]][C2[NPt]1 [C1[C][I2[NPt]1 [I1[It]1 [VP[VP[V talk]3 [I]1 ][PP[P to][NP]]]]]]]]]]]]]
- (39) [C2[NP john]1 [C1[C][I2[NPt]1 [I1[I(AGR)[I(AGR)]1 [V is]2 ]1 [VP[Vt]2 [AP[AP[ADV too][A stubborn]][C2[NPt]1 [C1[C][I2[NP]3 [I1[It]3 [VP[VP[V talk]4 [I]3 ][PP[P to][NPt]1 ]] $]$ ] $]$ ] $]$ ] $]+]]$
- (59) [C2[NP john]1 [C1[C][I2[NPt]1 [11[I(AGR)[I(AGR)]1 [V is]2 ]1 [VP[Vt]2 [AP[AP[ADV too][A stubborn]][C2[NPt]1 [C1[C][I2[NPt]1 [11[It]1 [VP[VP[V talk]3 [I]1 ][PP[P to][NP]]]]]]]]]]]]]
- (85) [C2[NP john]1 [C1[C][I2[NPt]1 [I1[I(AGR)[I(AGR)]1 [V is]2 ]1 [VP[Vt]2 [AP[AP[ADV too][A stubborn]][C2[NPt]1 [C1[C][I2[NPt]1 [I1[It]1 [VP[VP[V talk]3 [I]1 ][PP[P to][NP]] $]$ ] $]$ ] $]$ ] $]+]]]$

