

# 左角分析算法

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<http://ccl.pku.edu.cn/doubtfire>

D. J. Rosenkrantz and P. M. Lewis II., 1970, Deterministic left corner parsing. In IEEE Conference Record of the 11th Annual Symposium on Switching and Automata Theory, pages 139--152, 1970.

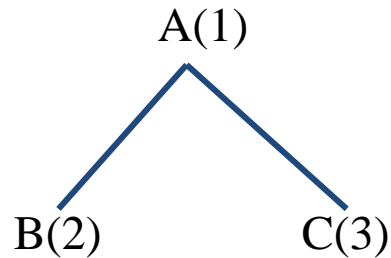
Mark-Jan Nederhof, 1993, Generalized left-corner parsing. In 6th Meeting of the European Association of Computational Linguistics (ACL), pages 305--314, Utrecht, Netherlands, 1993. 20

John Nerbonne, Computational Semantics, In The Handbook of Contemporary Semantic Theory, ed. by Shalom Lappin, Blackwell Publishers Ltd., 1996, p479.

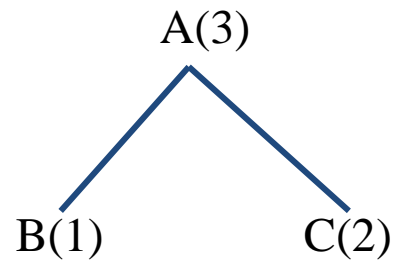
# 左角分析法

- 左角分析法是一种自顶向下和自底向上相结合的方法
- 所谓“左角(Left Corner)”是指任何一个句法子树中左下角的那个符号
- 比较:

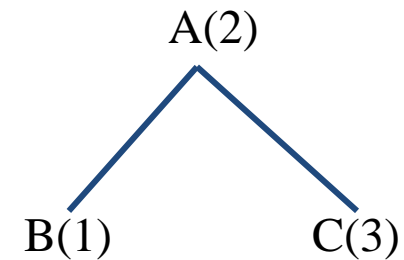
自顶向下分析法



自底向上分析法



左角分析法



# 左角分析法-基本思想

- 1 由箭头右部最左的非终结符去调用规则（自底向上，然后向下）
- 2 由终结符触发归约（即当碰到适合的终结符时，一条规则被满足）；
- 3 只有被满足的非终结符节点，才能进一步触发归约；
- 4 从历史上形成的离当前处理节点最近的最大的子树根节点开始回溯
- 5 回溯就是断开已经形成的子树的右分支（**right branch**），由右分支节点（非终结符或终结符）开始，重新调用规则进行预测（等待归约）

规则被满足指的是规则根节点覆盖了终结符序列中的一个子串

# 左角分析法-算法描述1

表示B是A的左角  
比如 $S \rightarrow NP VP$ ,  
则  $NP L^* S$

- 1a. If the element on top of the stack is the nonterminal **A** and if the first symbol of the remaining input is **t**, then we may remove **t** from the input and push an item  $[B \rightarrow t \cdot \alpha]$  onto the stack, provided  $B L^* A$ .
- 1b. If the element on top of the stack is the nonterminal **A**, then we may push an item  $[B \rightarrow \cdot]$  onto the stack, provided  $B L^* A$ . (The item  $[B \rightarrow \cdot]$  is derived from an epsilon rule  $B \rightarrow \epsilon$ )
2. If the element on top of the stack is the item  $[A \rightarrow \alpha \cdot t \beta]$  and if the first symbol of the remaining input is **t**, then we may remove **t** from the input and replace the item by the item  $[A \rightarrow \alpha t \cdot \beta]$ .
3. If the top-most two elements on the stack are  $B [A \rightarrow \alpha \cdot]$ , then we may replace the item by an item of the form  $[C \rightarrow A \cdot \beta]$ , provided  $C L^* B$ .
4. If the top-most three elements on the stack are  $[B \rightarrow \beta \cdot A \gamma] A [A \rightarrow \alpha \cdot]$ , then we may replace these three elements by the item  $[B \rightarrow \beta A \cdot \gamma]$ .
5. If a step according to one of the previous clauses ends with an item  $[A \rightarrow \alpha \cdot B \beta]$  on top of the stack, where B is a nonterminal, then we subsequently push B onto the stack.
6. If the stack consists only of the two elements  $S [S \rightarrow \alpha \cdot]$  and if the input has been completely read, then we may successfully terminate the parsing process.

# 左角分析法-算法描述2

```
Proc LC_Parse( $\alpha$ :nonterminal-category)
```

```
begin
```

```
  read next word W;
```

```
  CAT  $\leftarrow$  CAT(W);
```

```
  if CAT =  $\alpha$  then SUCCESS
```

```
  else
```

```
    if IS-LC(CAT,  $\alpha$ ) then expand_lc(CAT,  $\alpha$ )
```

```
    else FAIL
```

```
    endif
```

```
  endif
```

```
end LC_Parse
```

```
Proc expand_lc(CAT,goal)
```

```
begin
```

```
  for-each rule  $\beta \rightarrow$  CAT  $\gamma$ 
```

```
    if IS-LC(CAT, goal) then
```

```
      LC_Parse( $\gamma$ );
```

```
      if end-of-input then SUCCESS
```

```
      else expand_lc( $\beta$ ,goal)
```

```
      endif
```

```
    endif
```

```
  end-for-each
```

```
end expand_lc
```

IS-LC(A,B)函数  
用来判断  
A是否为B的左角

# 左角分析法示例-1

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

查词典

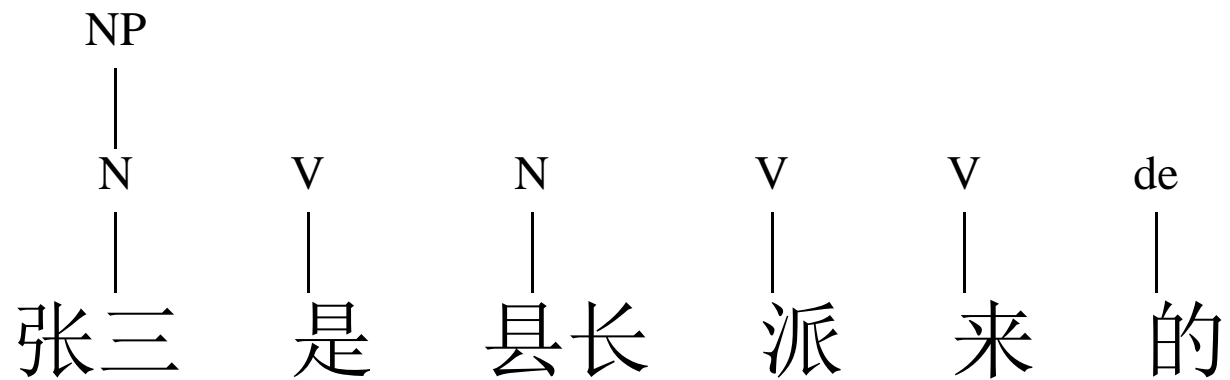
N	V	N	V	V	de
张三	是	县长	派	来	的

# 左角分析法示例-2

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

使用规则：

$NP \rightarrow N$

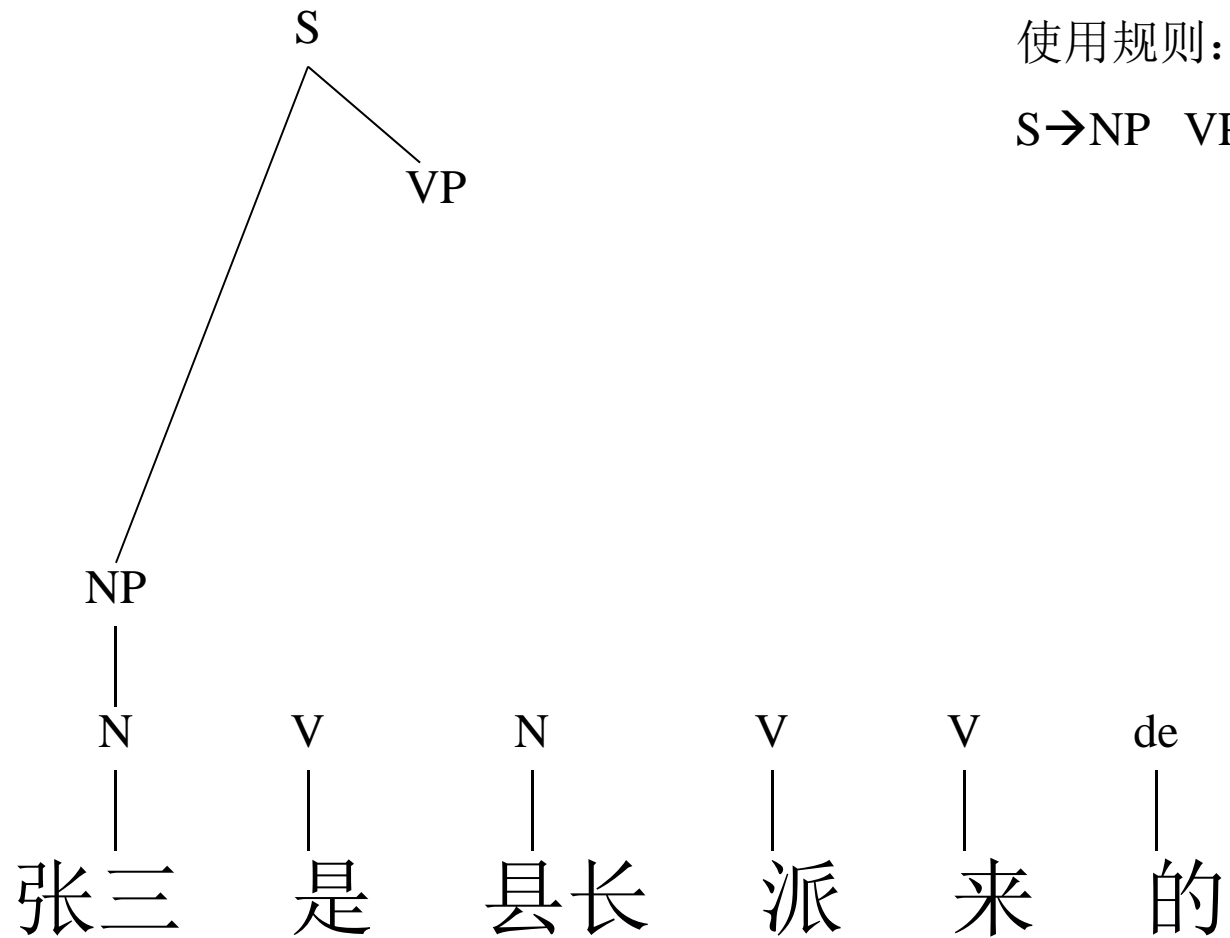


# 左角分析法示例-3

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

使用规则：

$S \rightarrow NP VP$

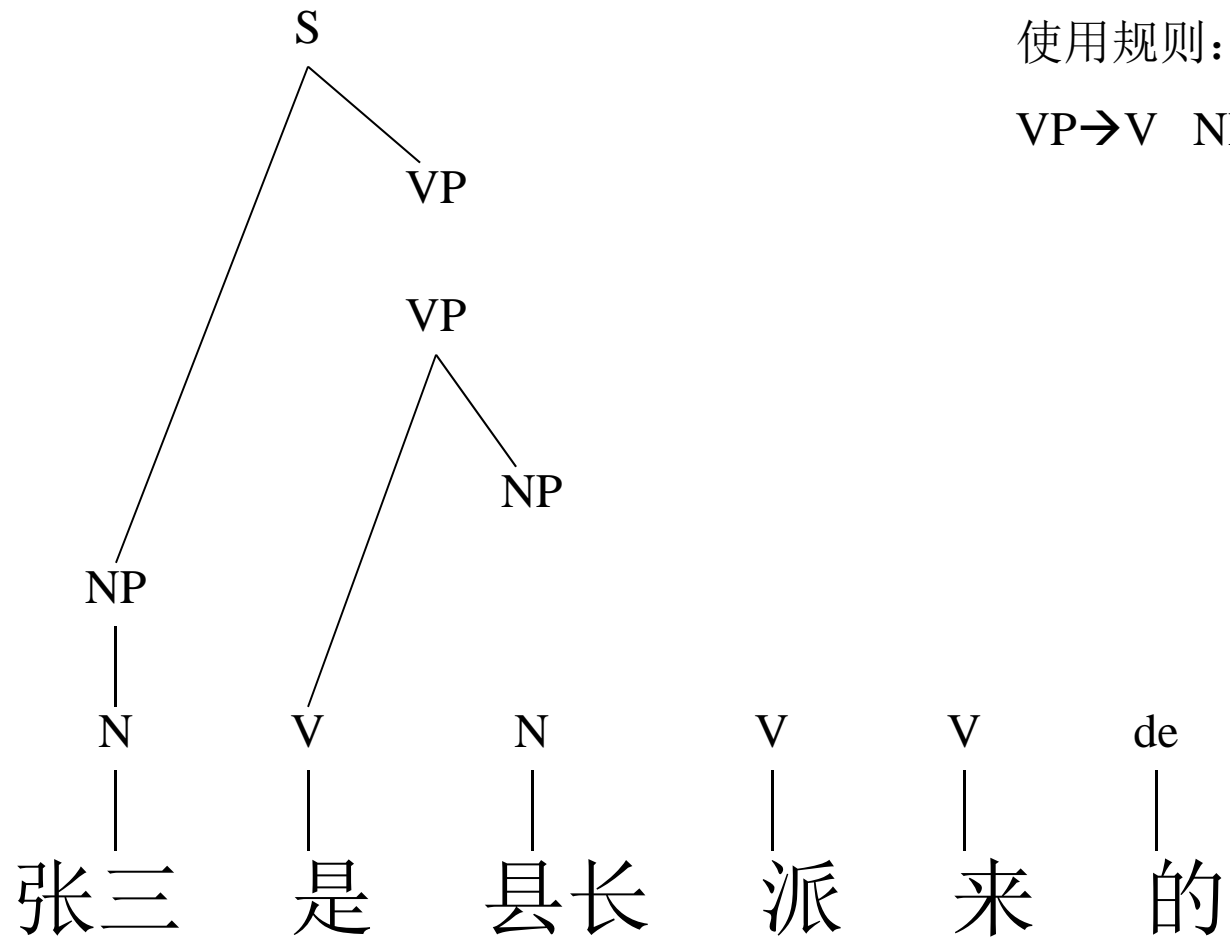


# 左角分析法示例-4

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

使用规则：

$VP \rightarrow V NP$

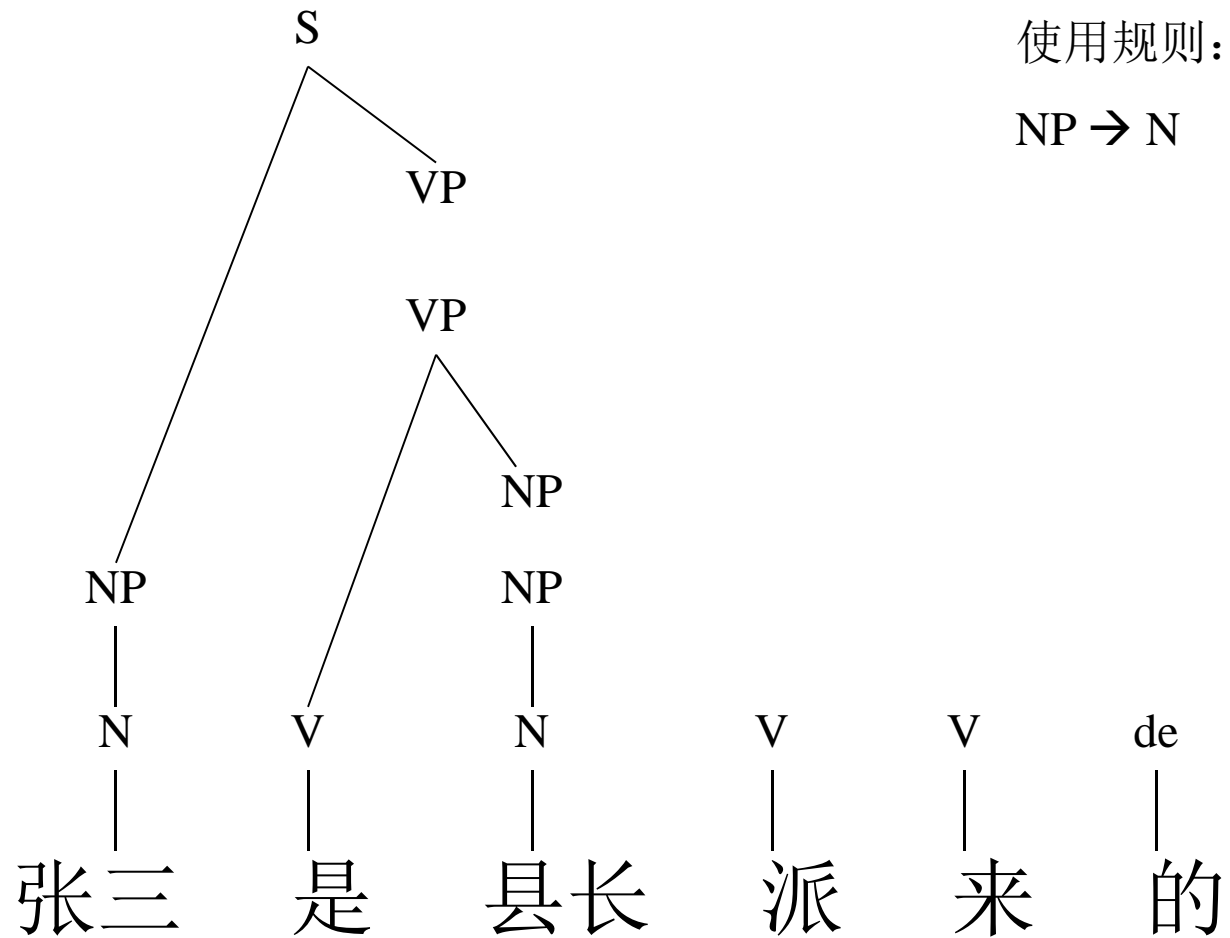


# 左角分析法示例-5

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

使用规则:

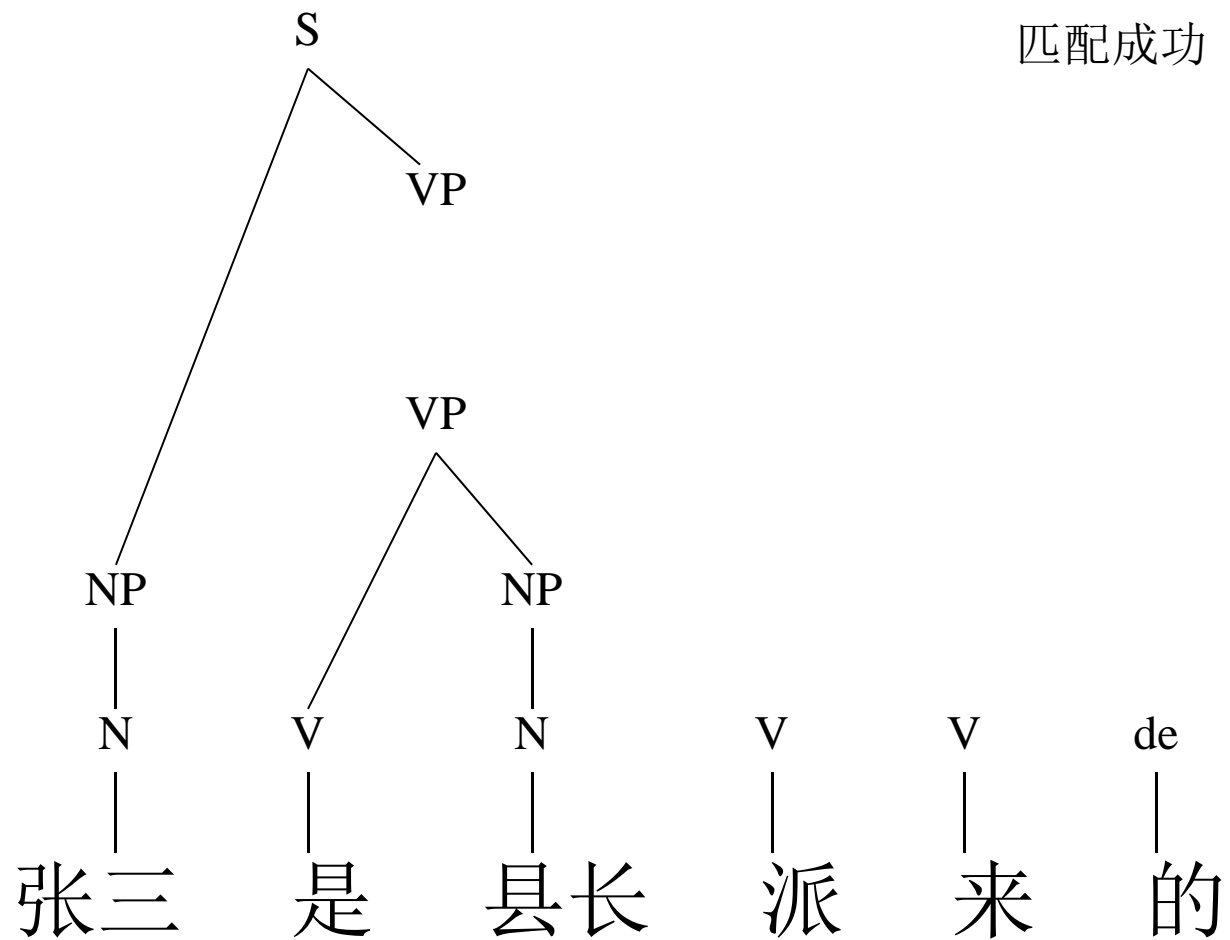
$NP \rightarrow N$



# 左角分析法示例-6

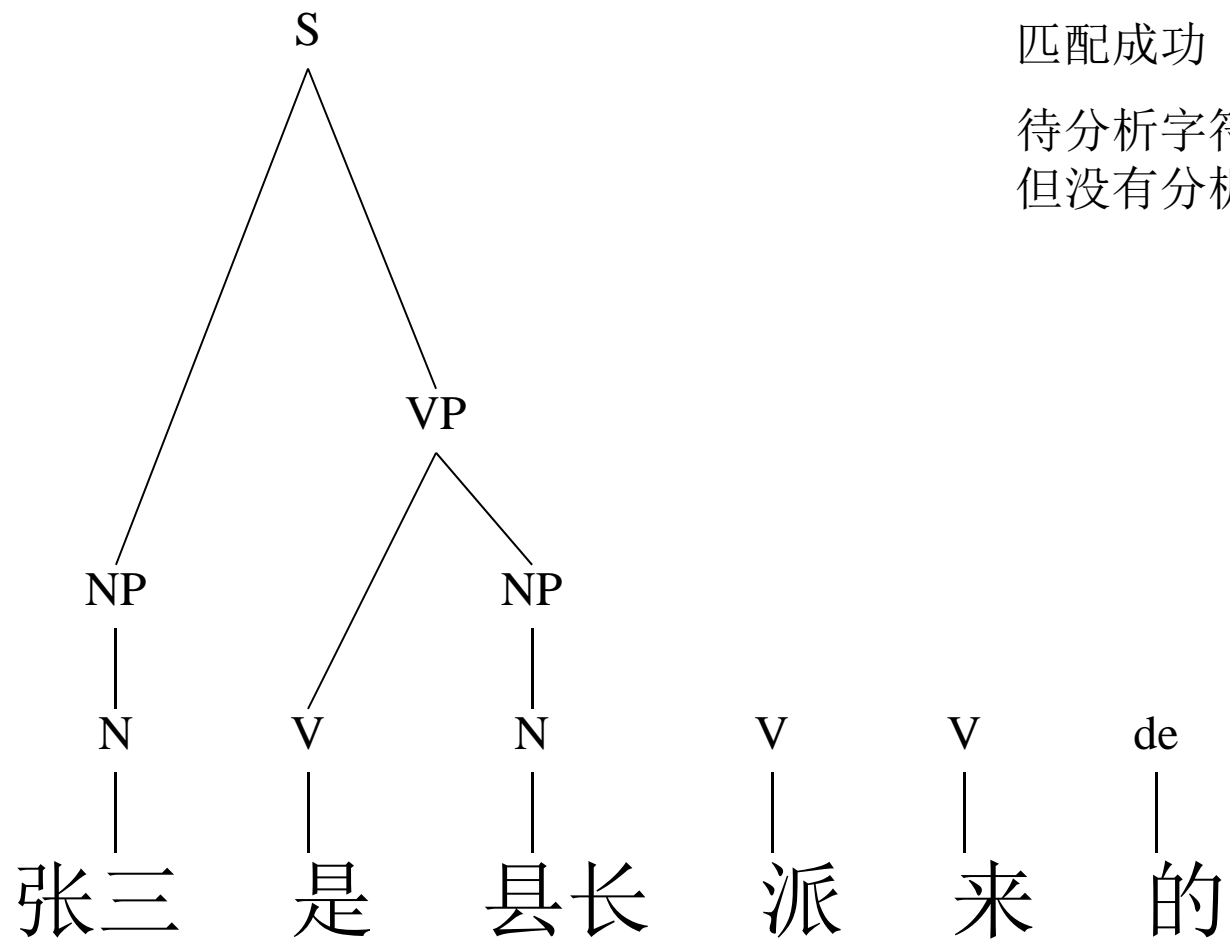
- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

匹配成功



# 左角分析法示例-7

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

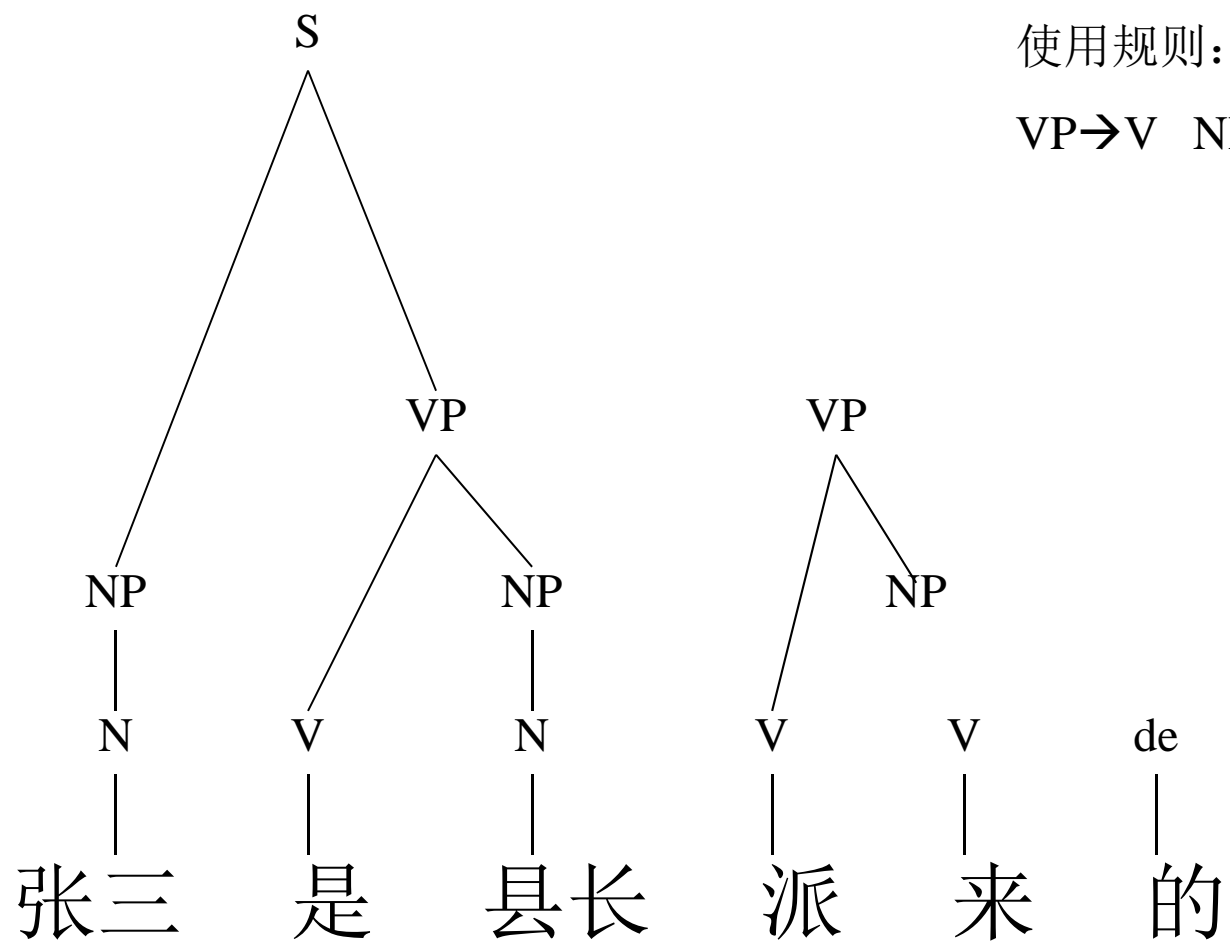


# 左角分析法示例-8

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

使用规则：

$VP \rightarrow V NP$

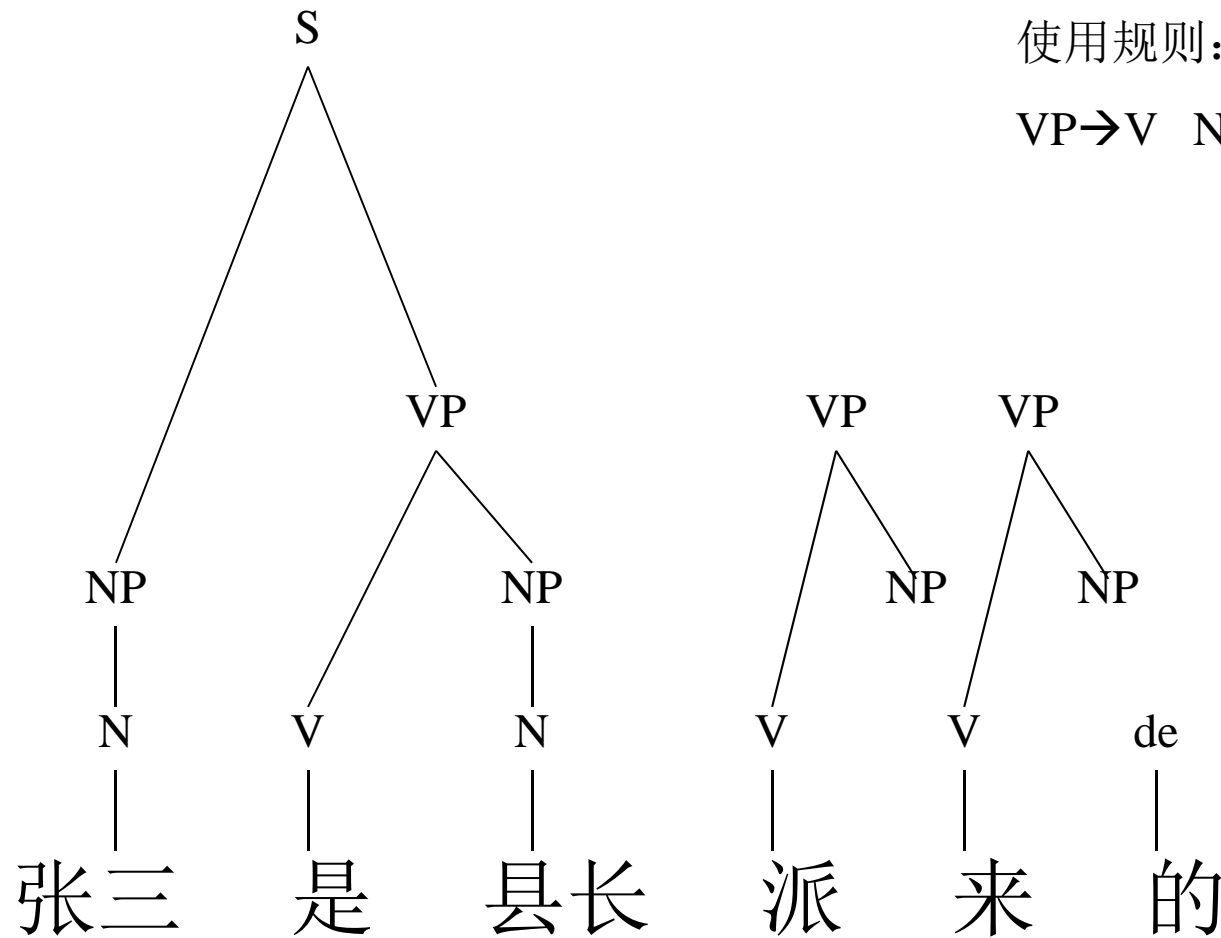


# 左角分析法示例-9

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

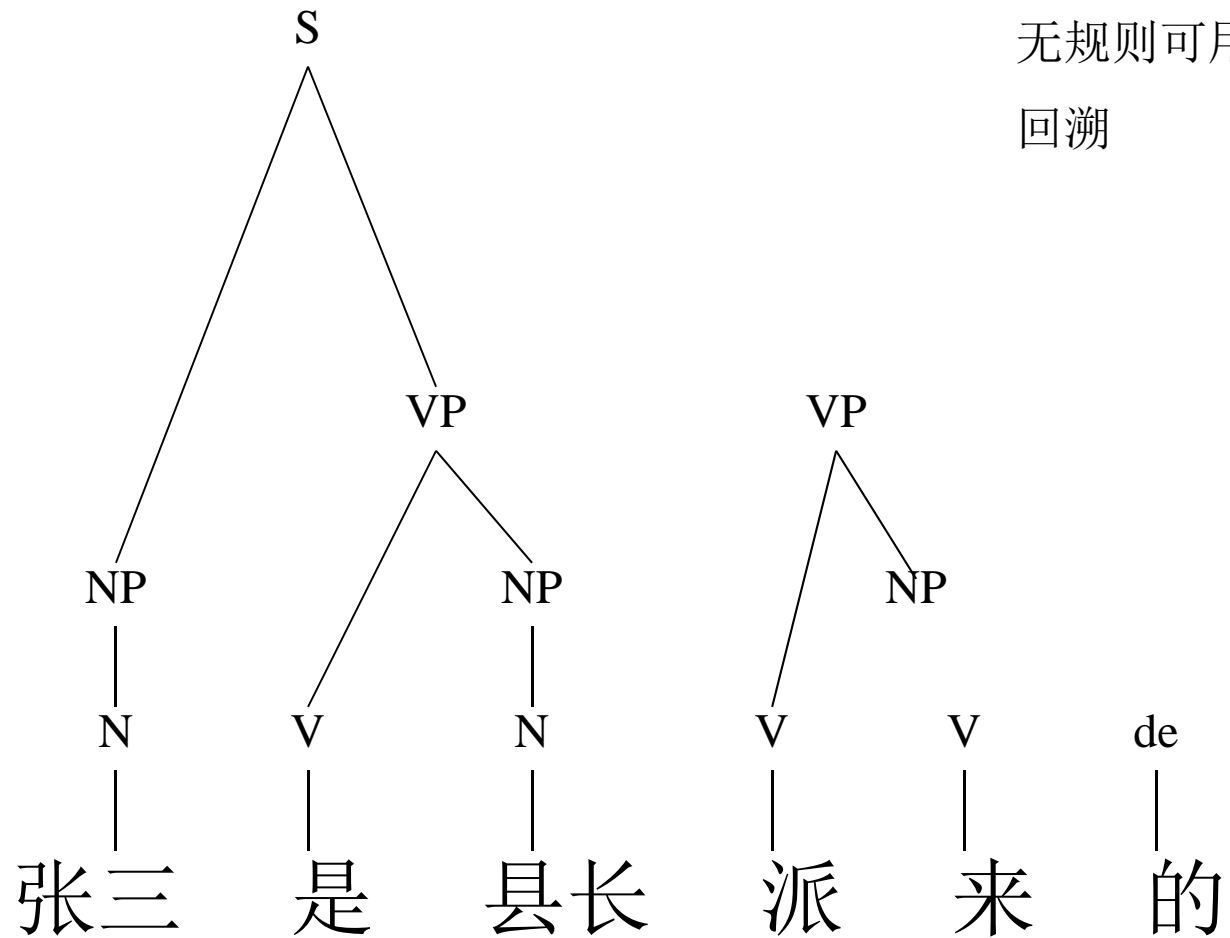
使用规则：

$VP \rightarrow V NP$



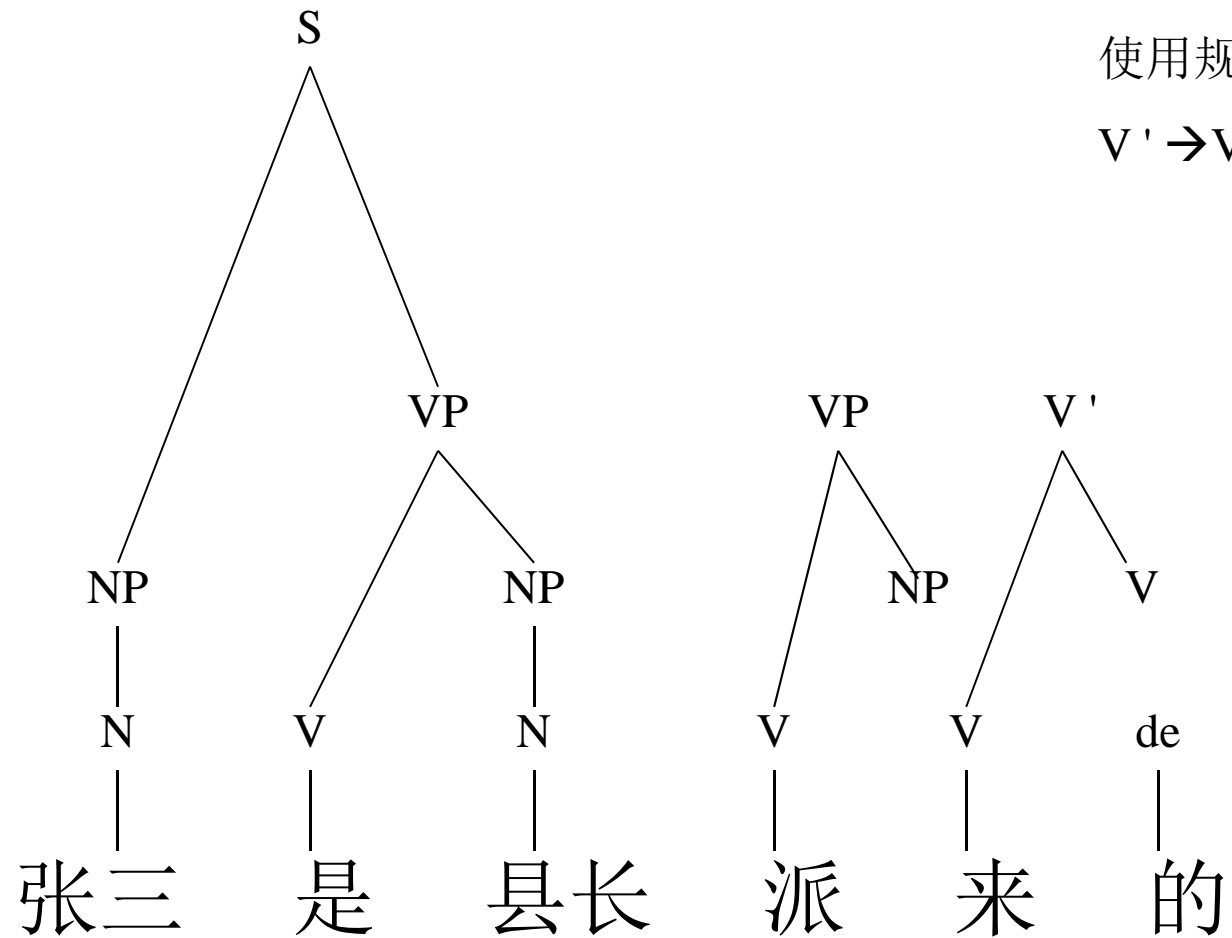
# 左角分析法示例-10

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$



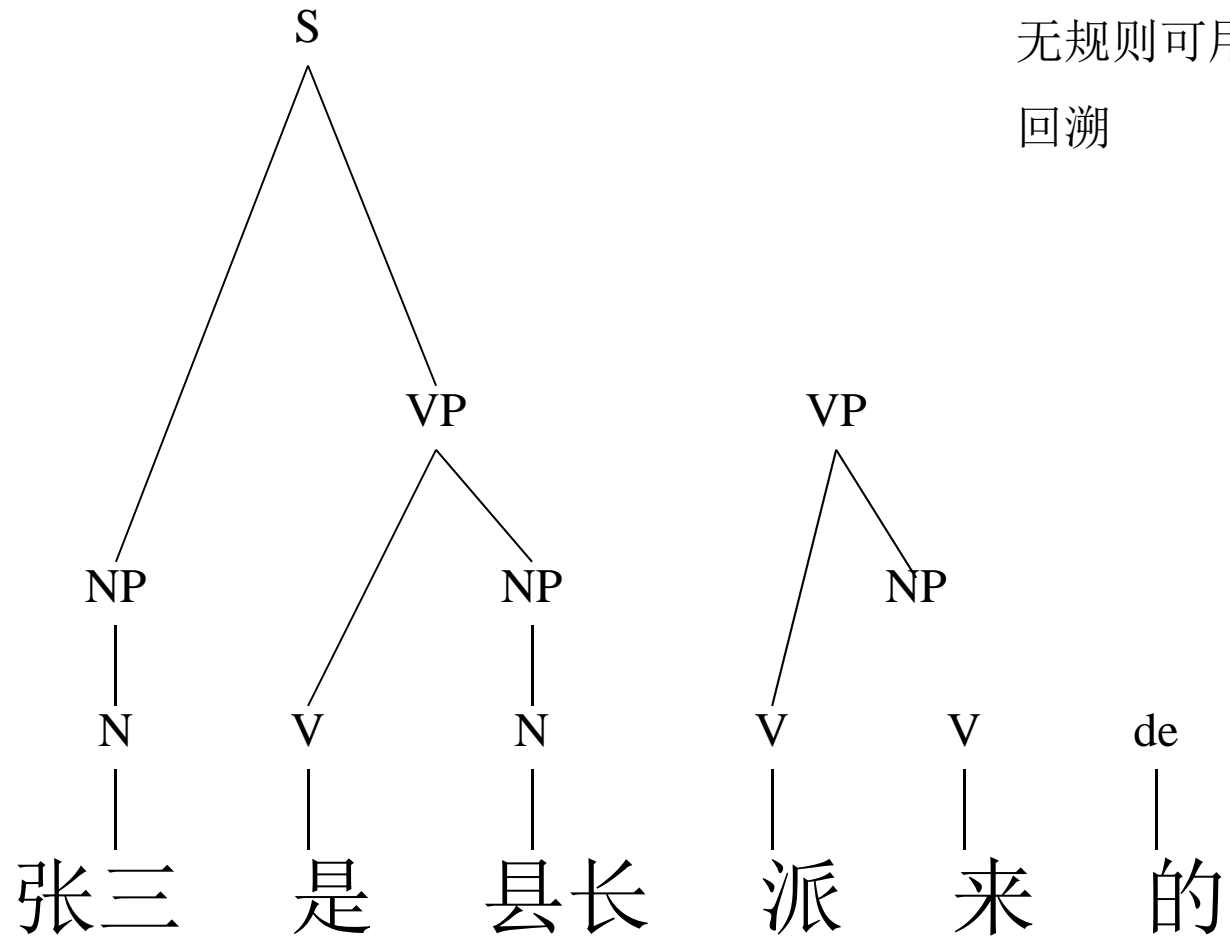
# 左角分析法示例-11

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$



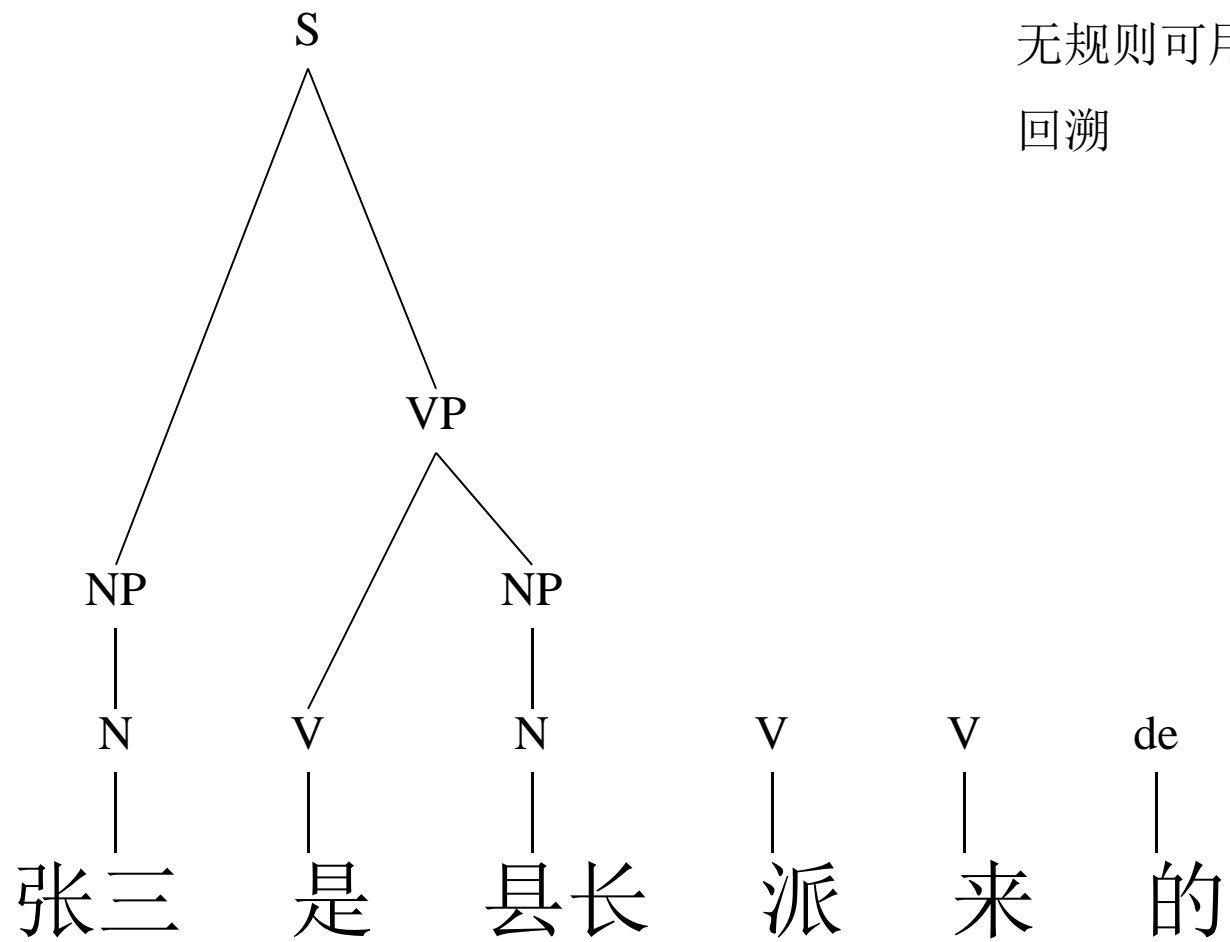
# 左角分析法示例-12

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$



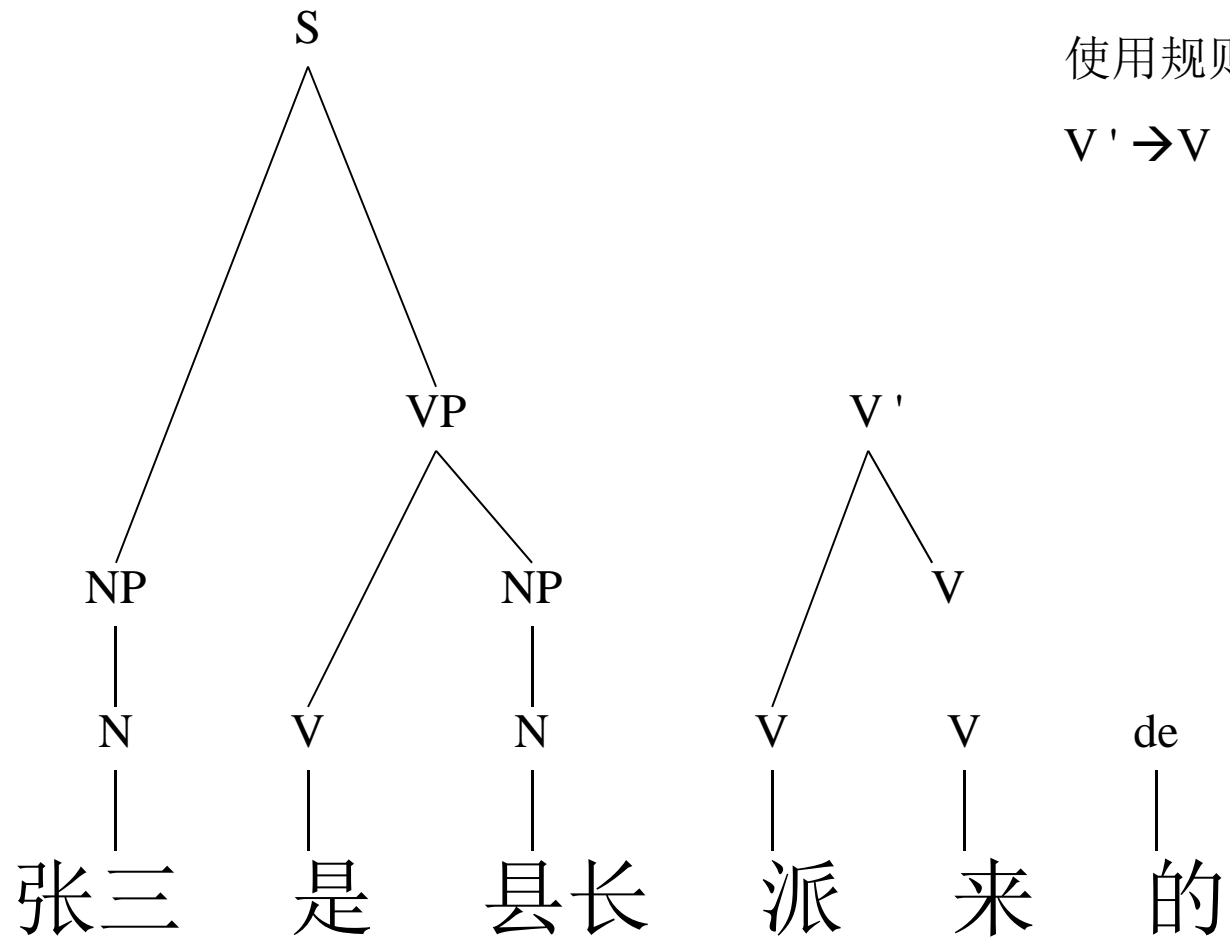
# 左角分析法示例-13

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$



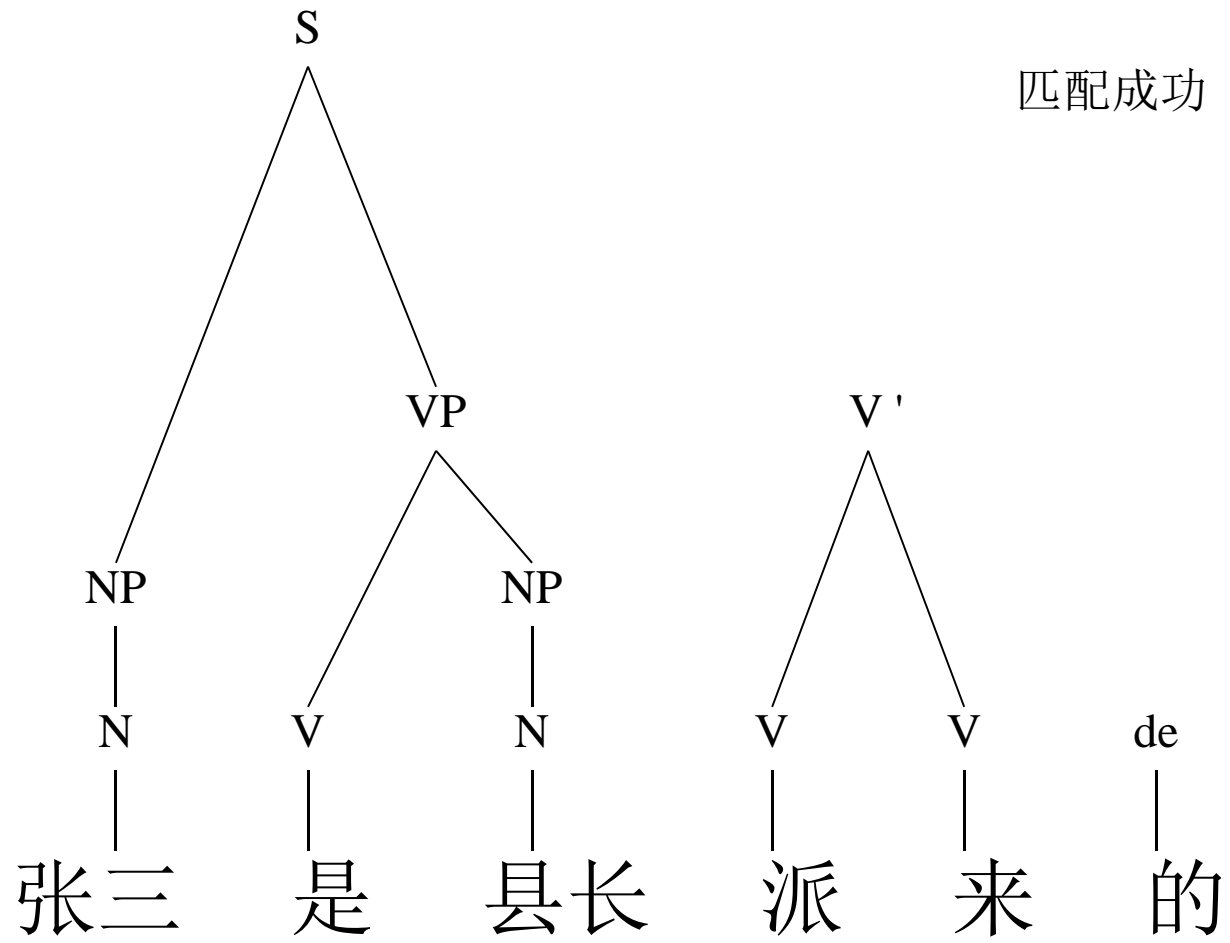
# 左角分析法示例-14

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$



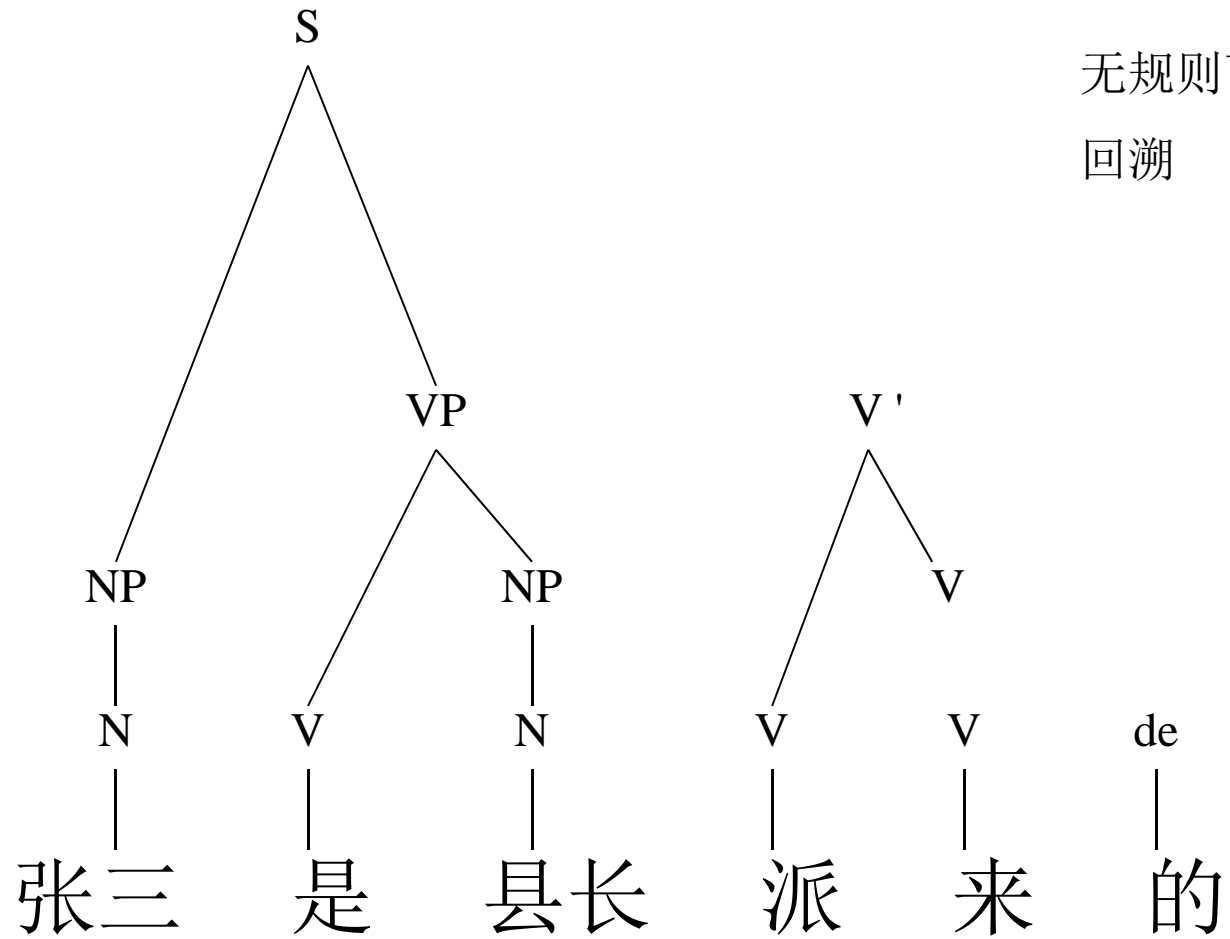
# 左角分析法示例-15

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$



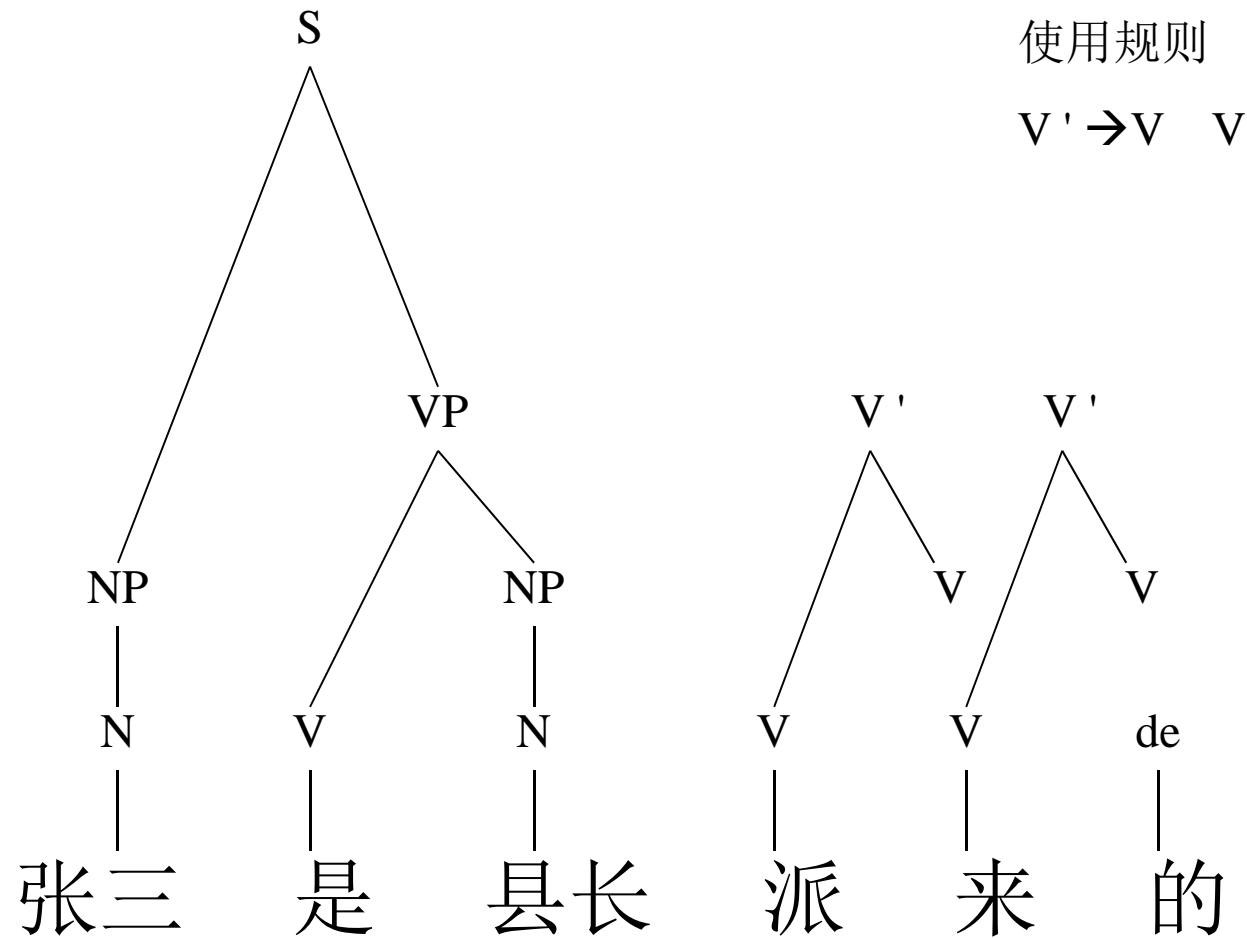
# 左角分析法示例-16

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$



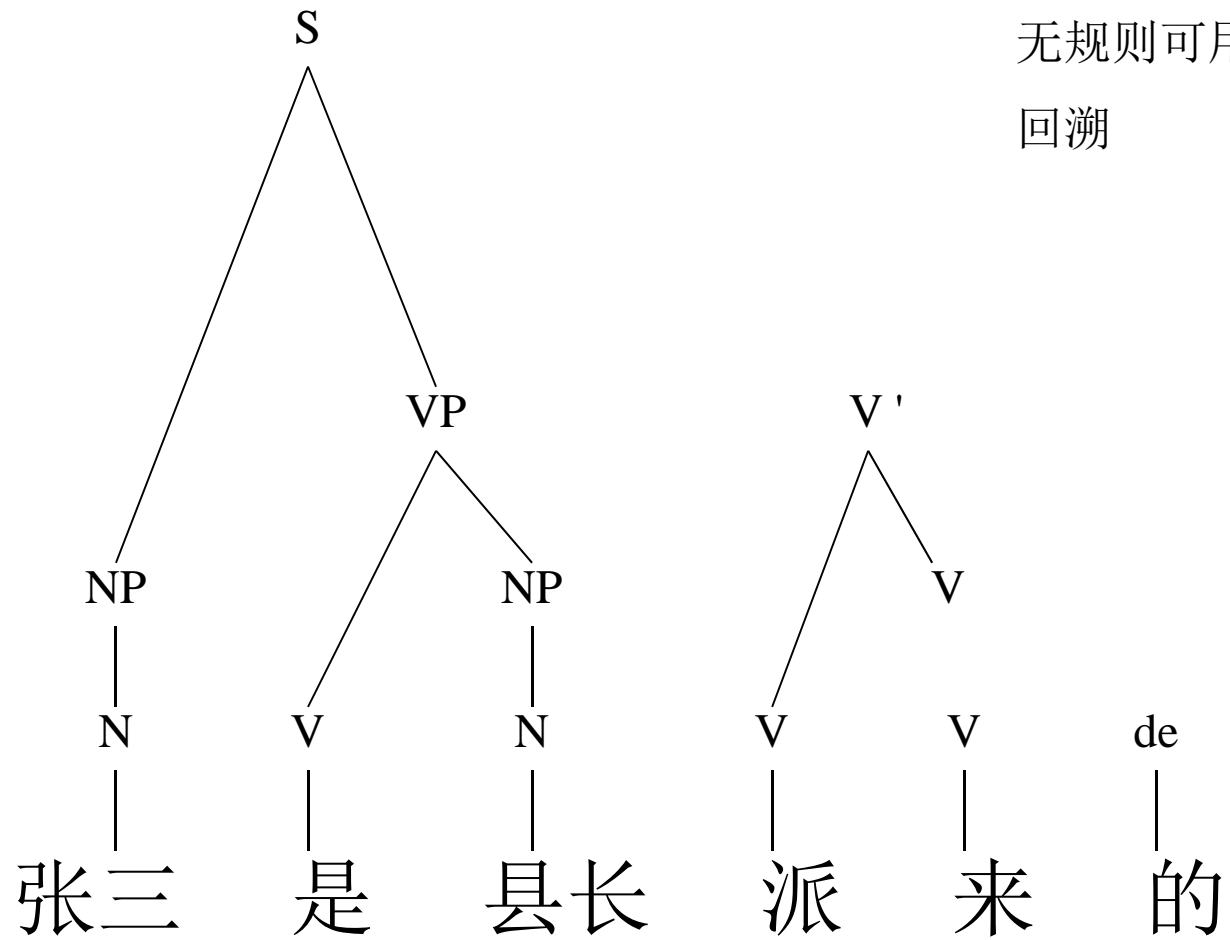
# 左角分析法示例-17

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$



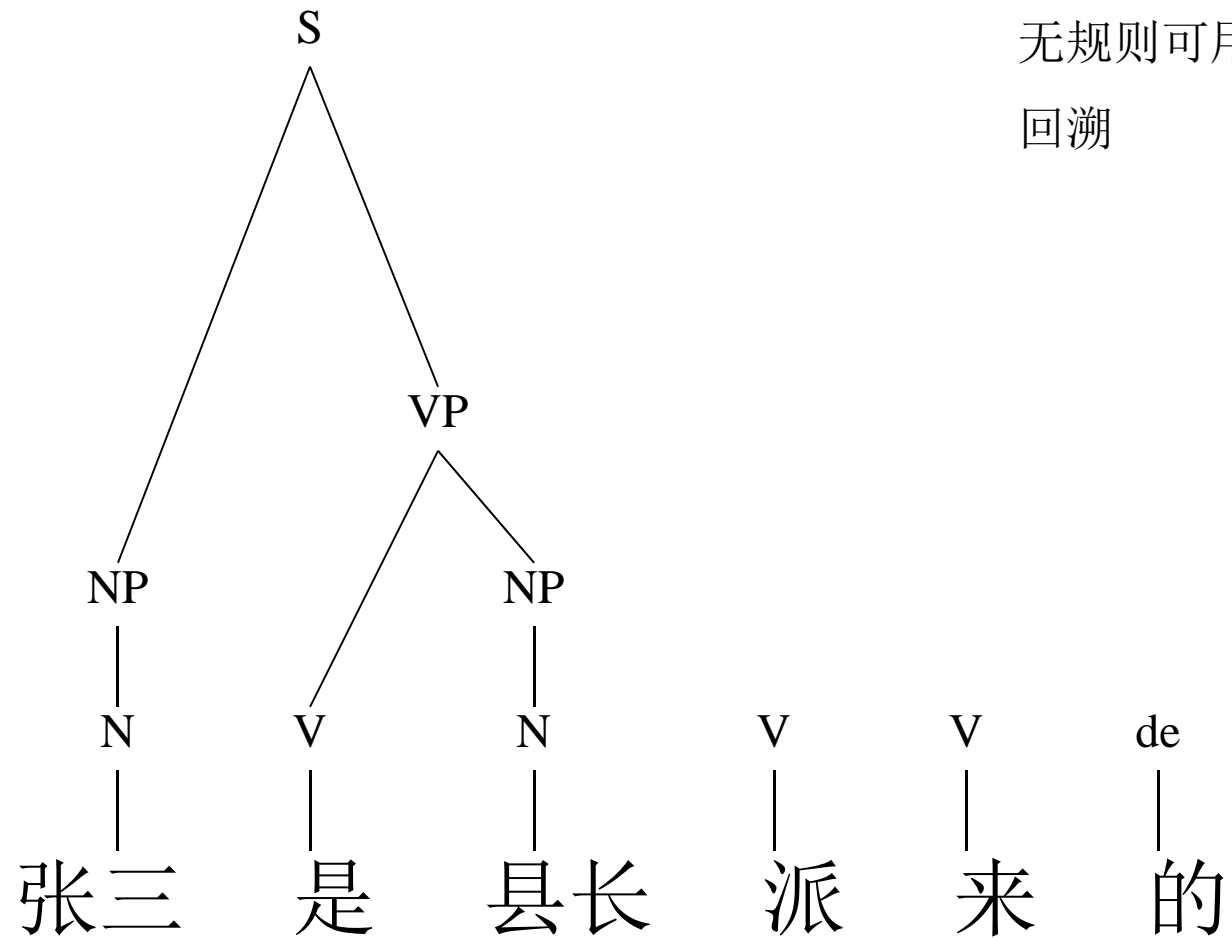
# 左角分析法示例-18

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$



# 左角分析法示例-19

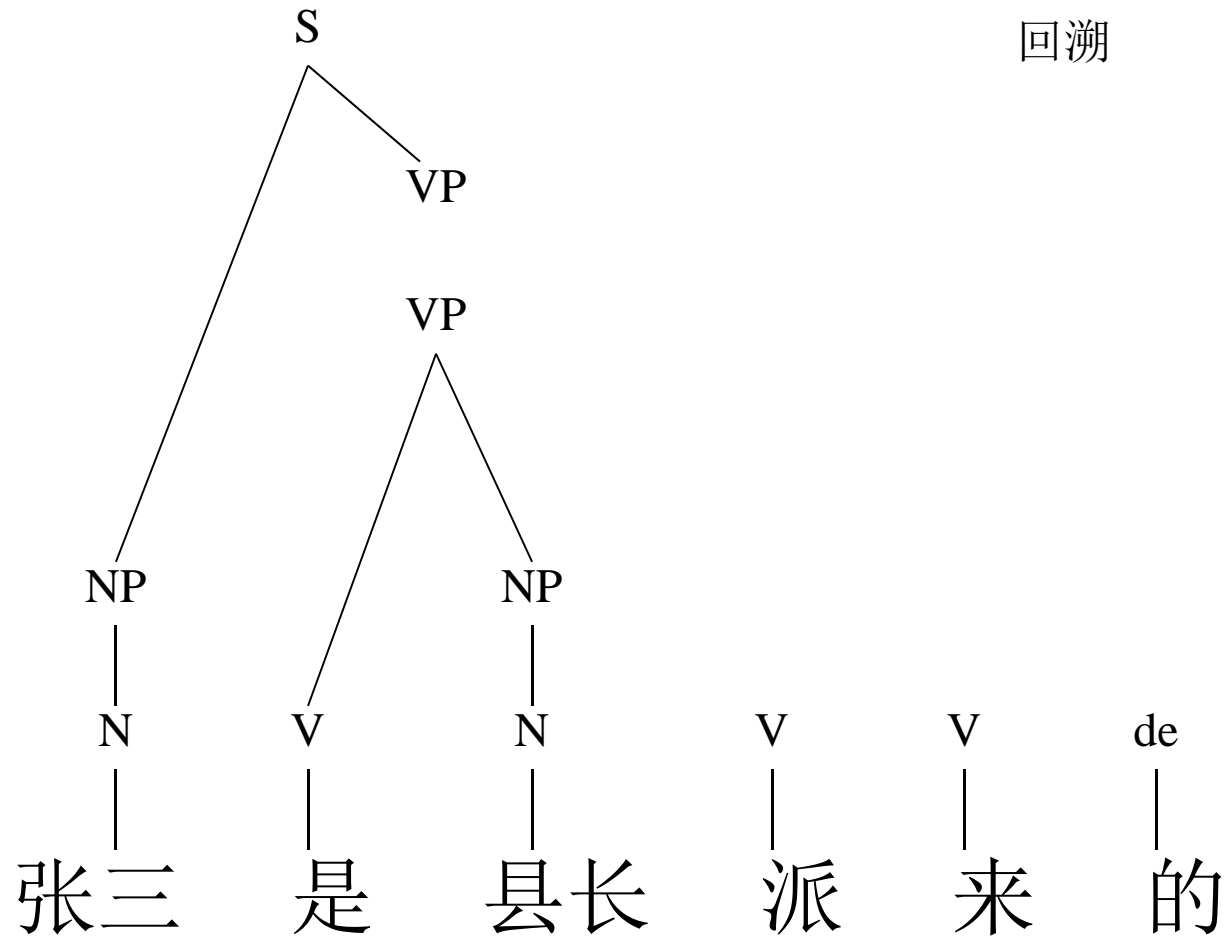
- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$



# 左角分析法示例-20

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

回溯

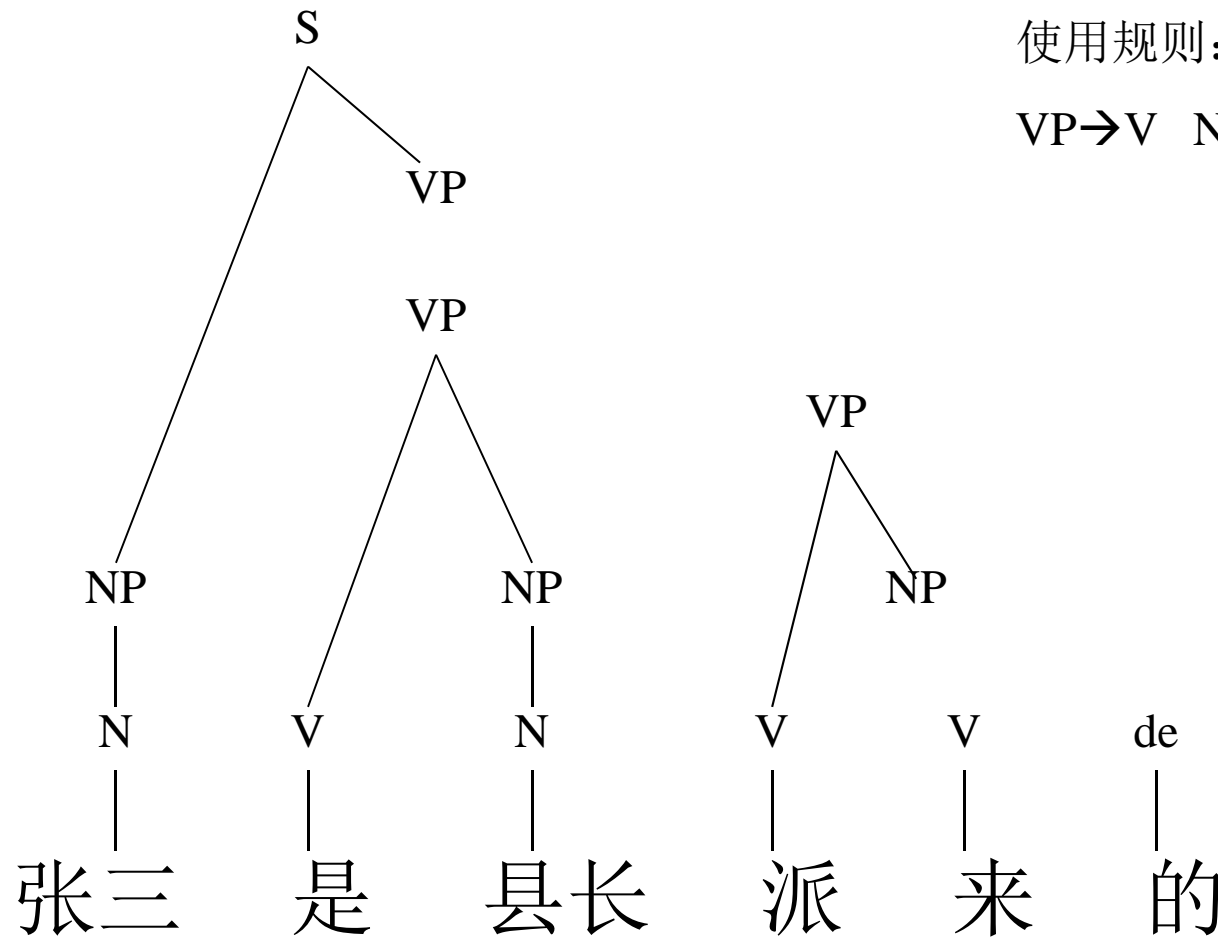


# 左角分析法示例-21

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

使用规则：

$VP \rightarrow V NP$

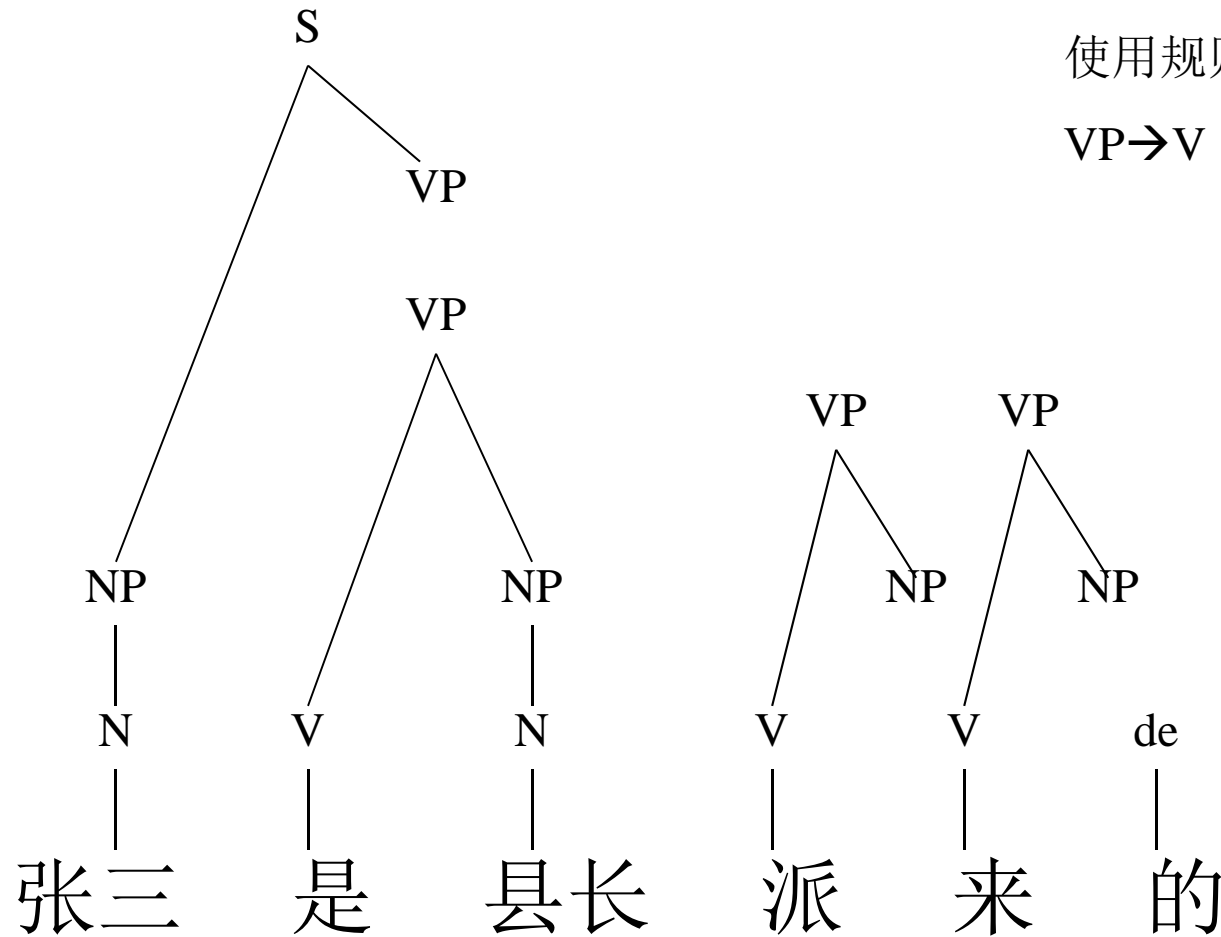


# 左角分析法示例-22

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

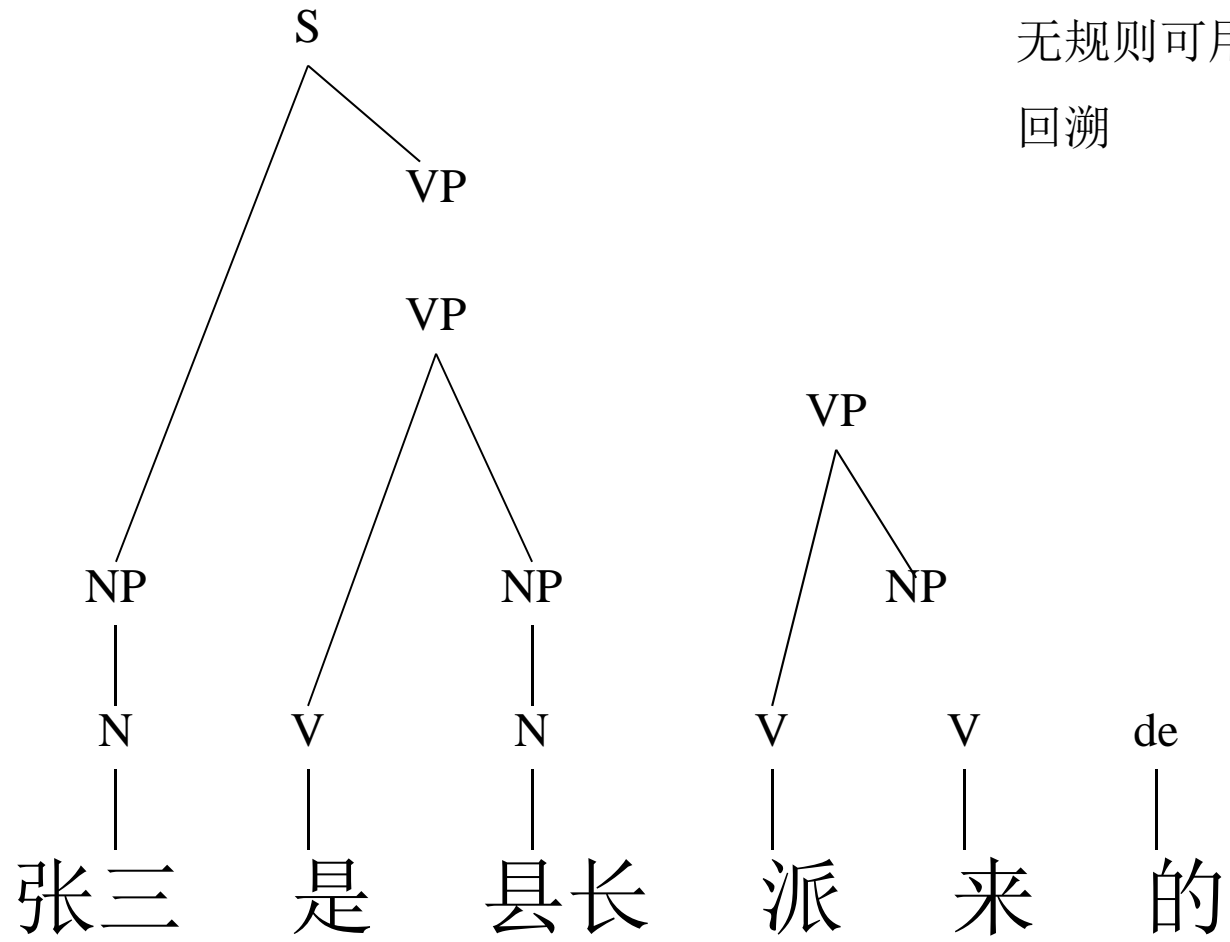
使用规则:

$VP \rightarrow V NP$



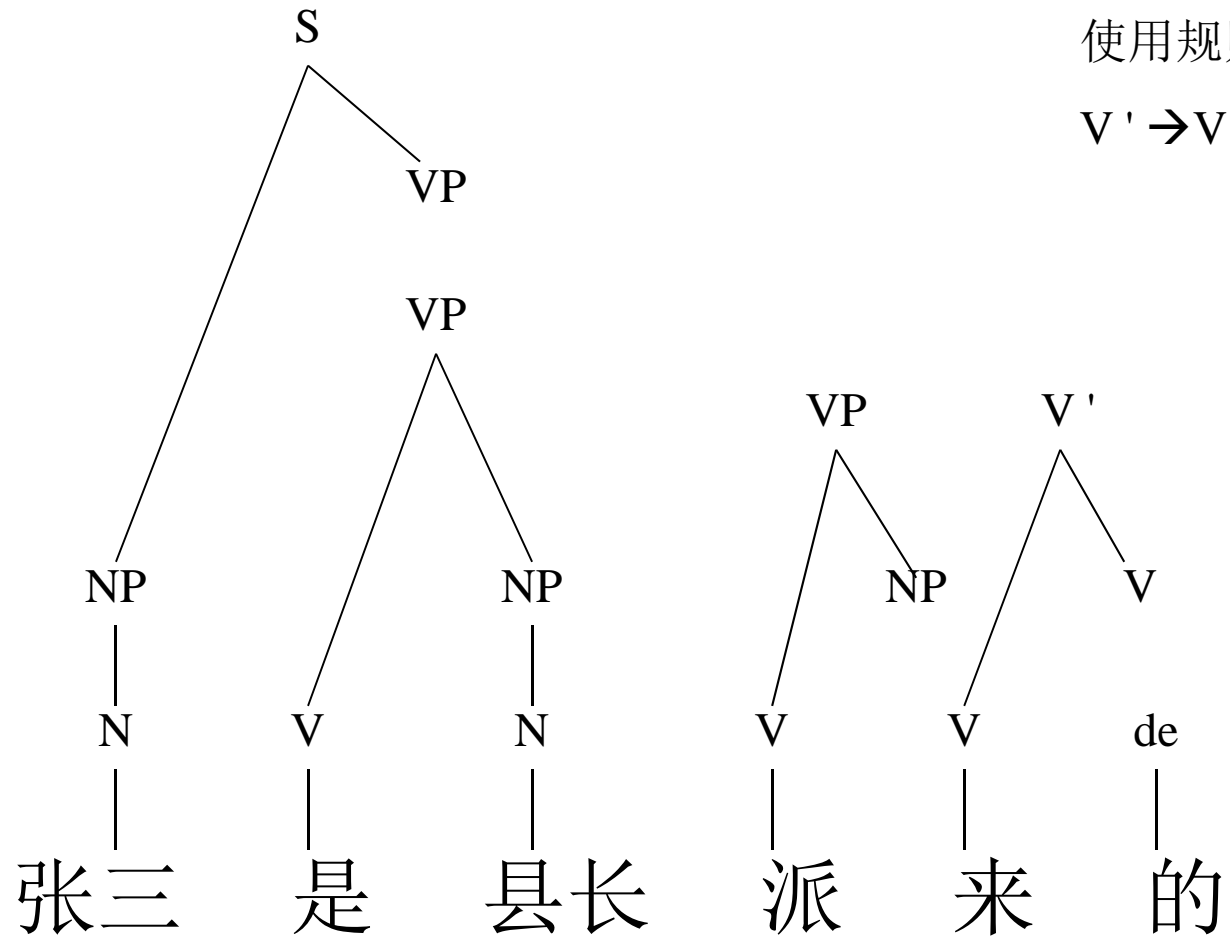
# 左角分析法示例-23

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$



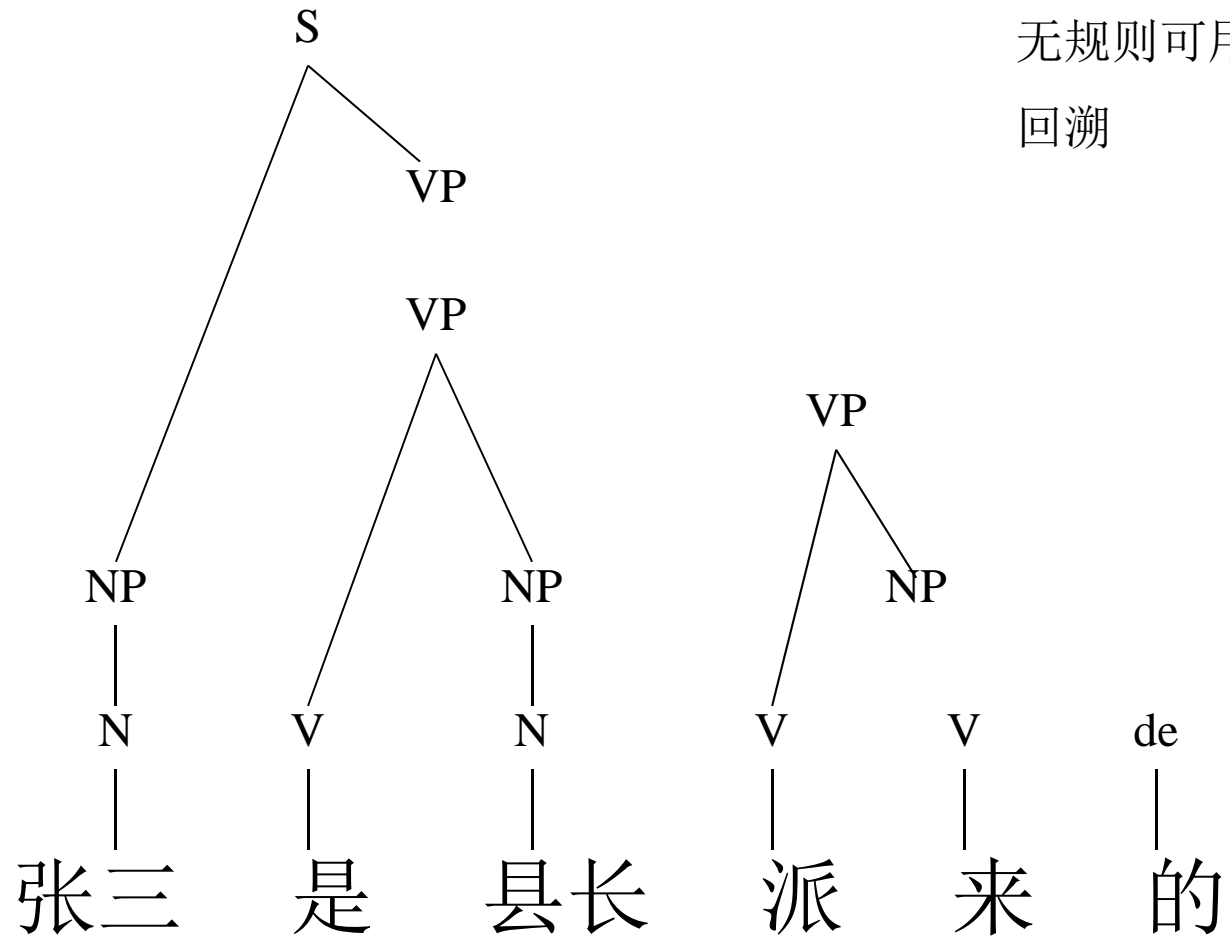
# 左角分析法示例-24

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$



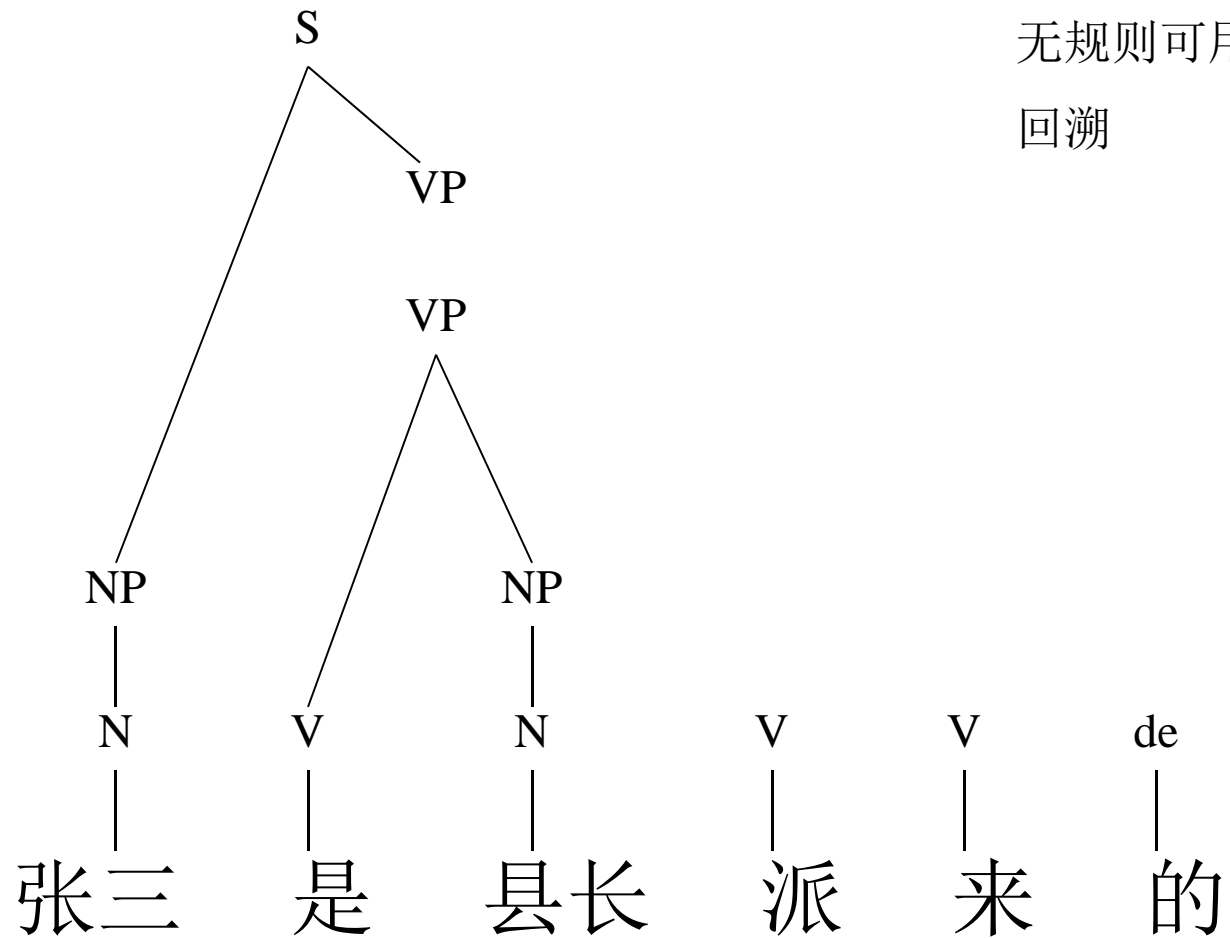
# 左角分析法示例-25

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$



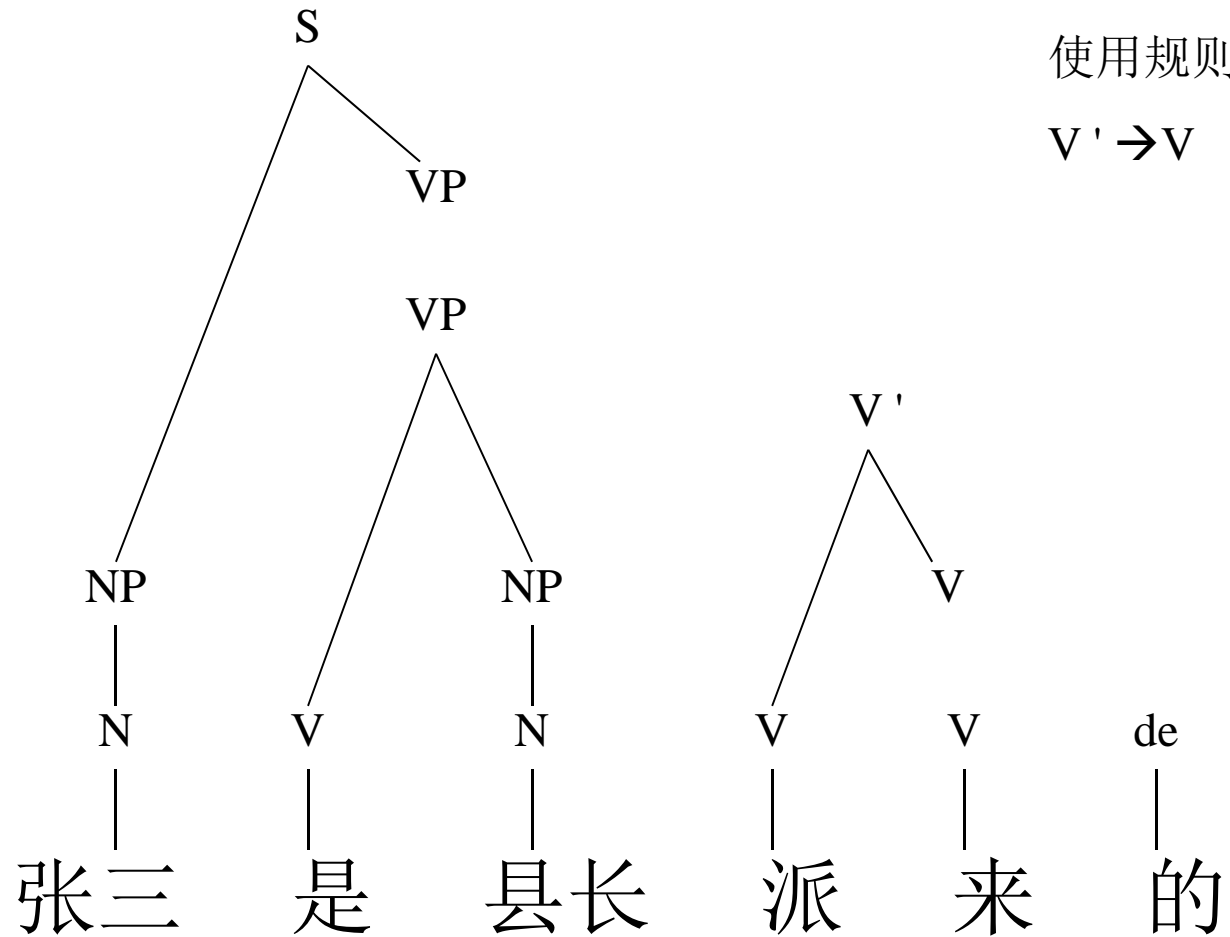
# 左角分析法示例-26

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$



# 左角分析法示例-27

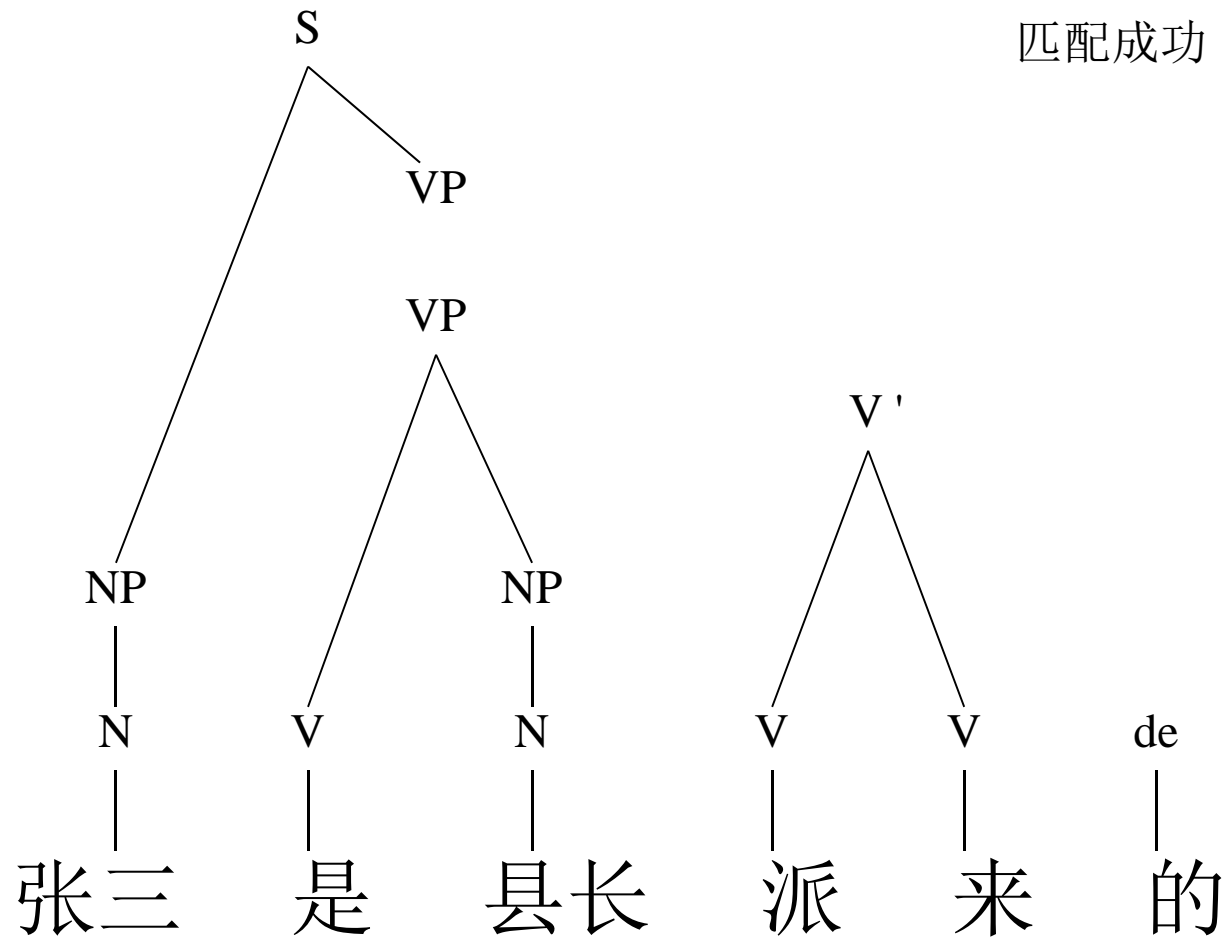
- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$



# 左角分析法示例-28

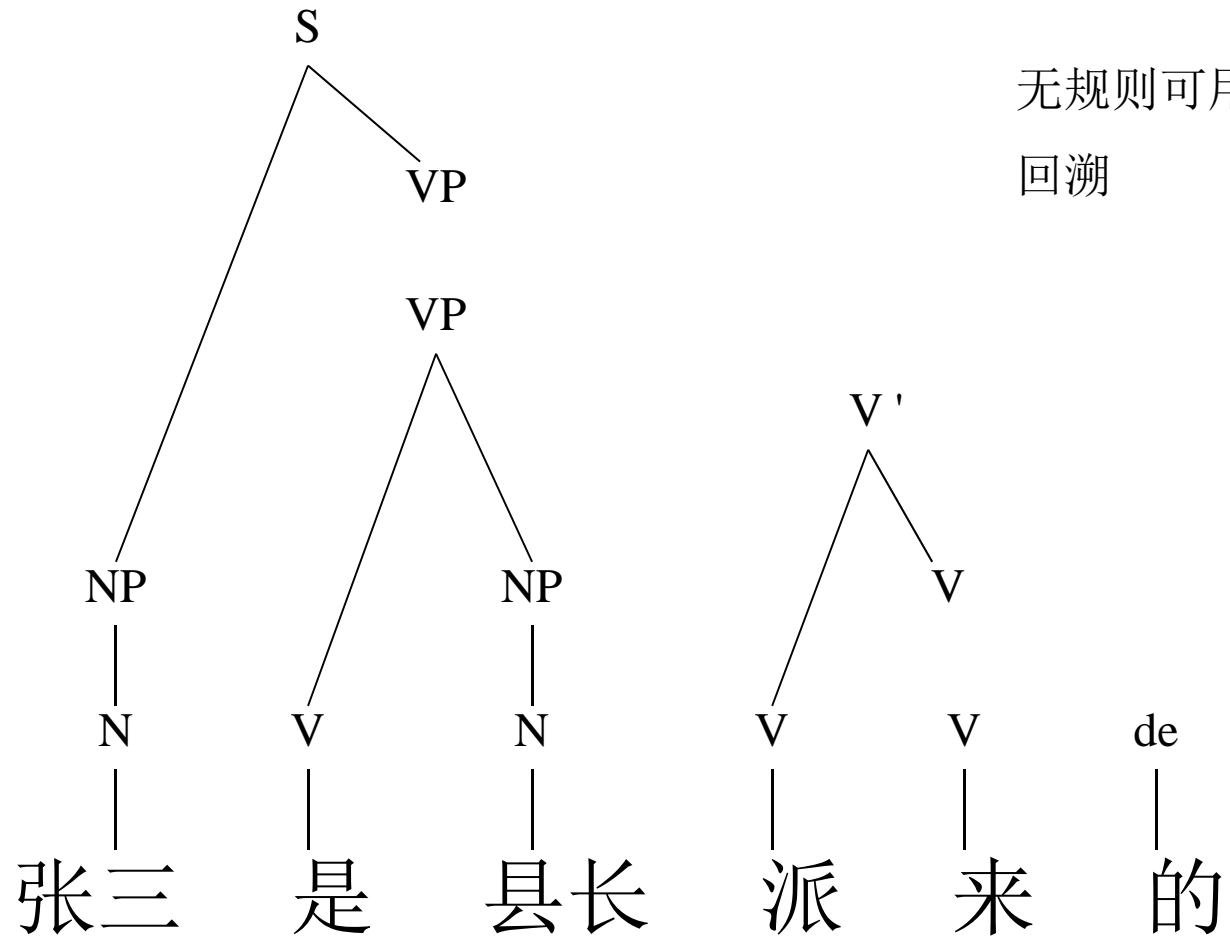
- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

匹配成功



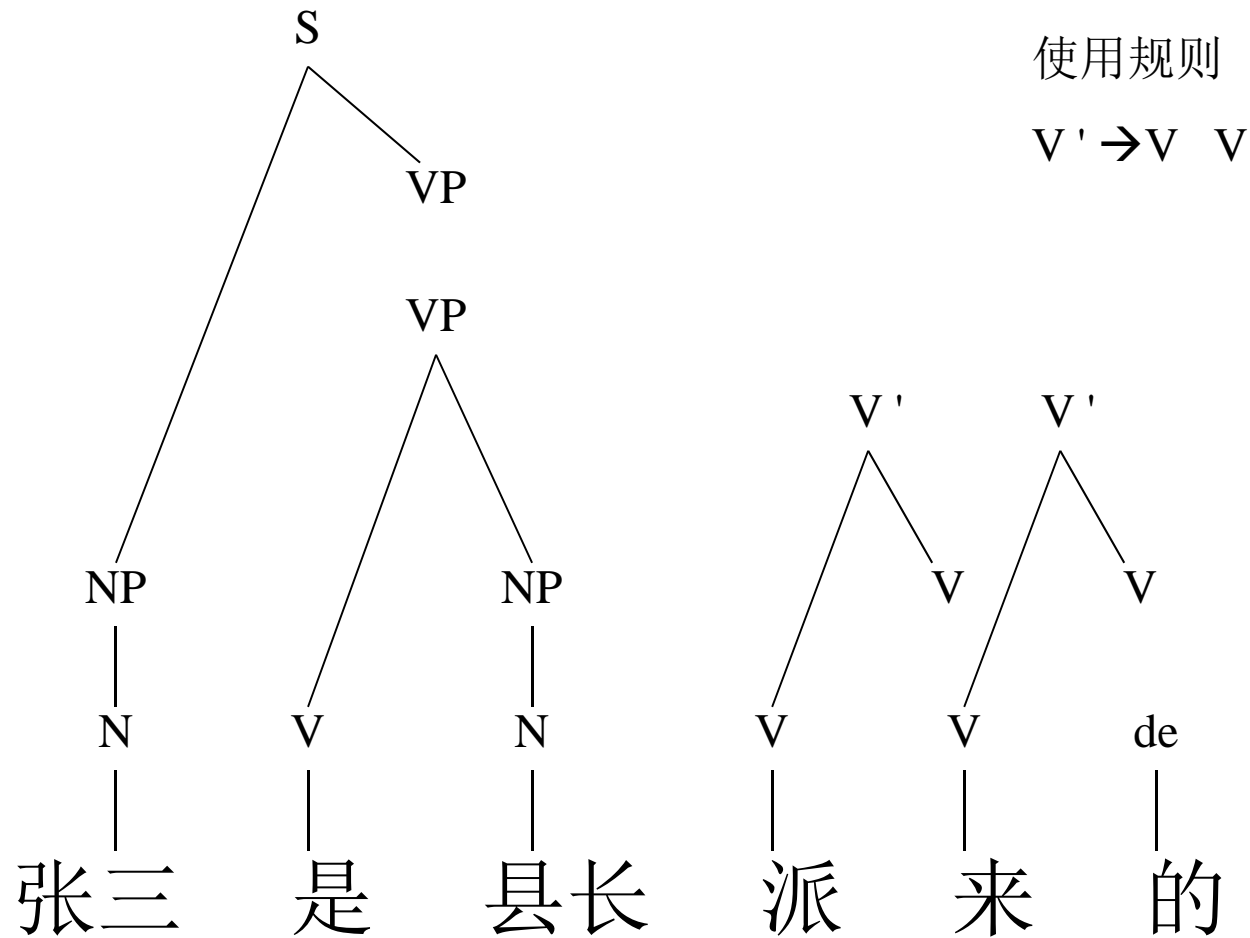
# 左角分析法示例-29

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$



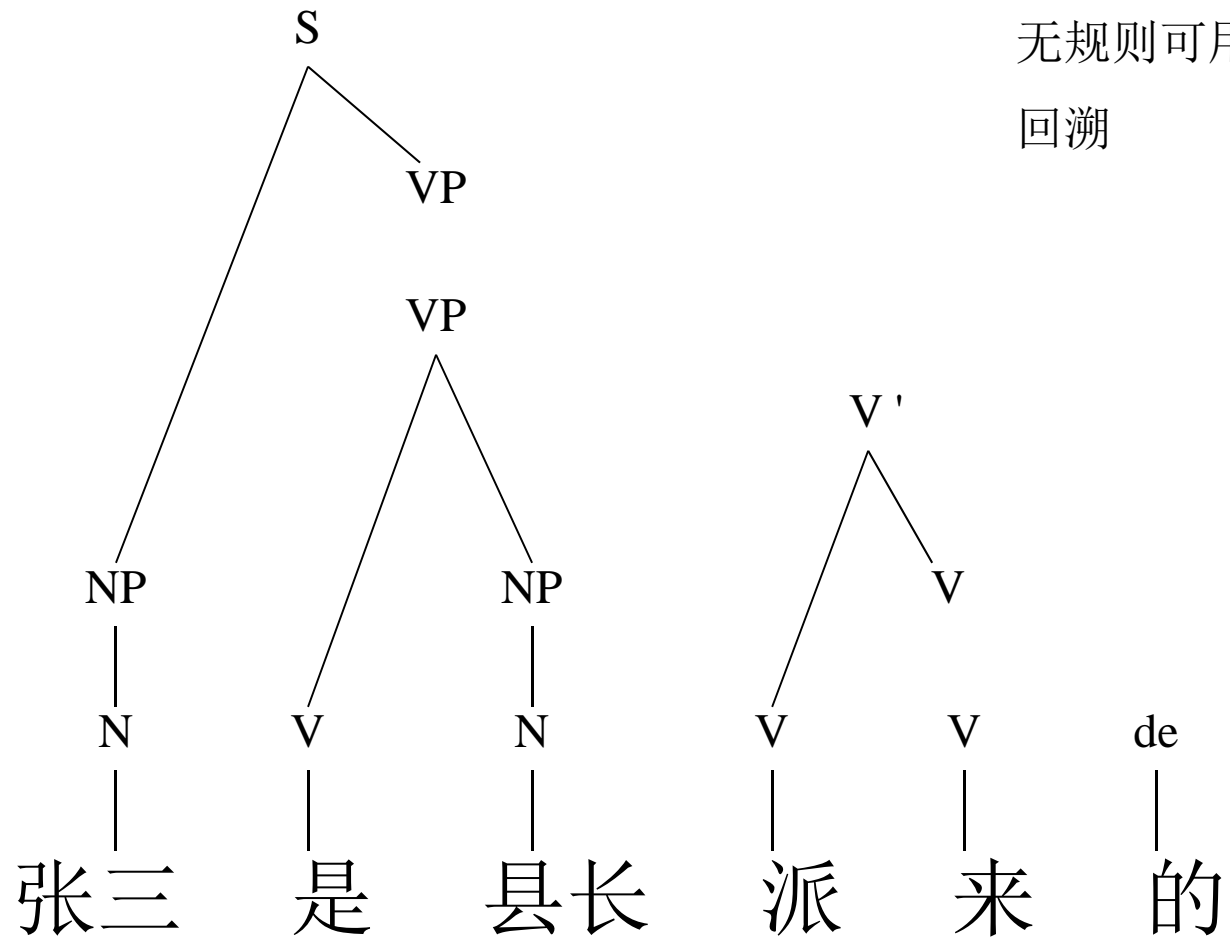
# 左角分析法示例-30

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$



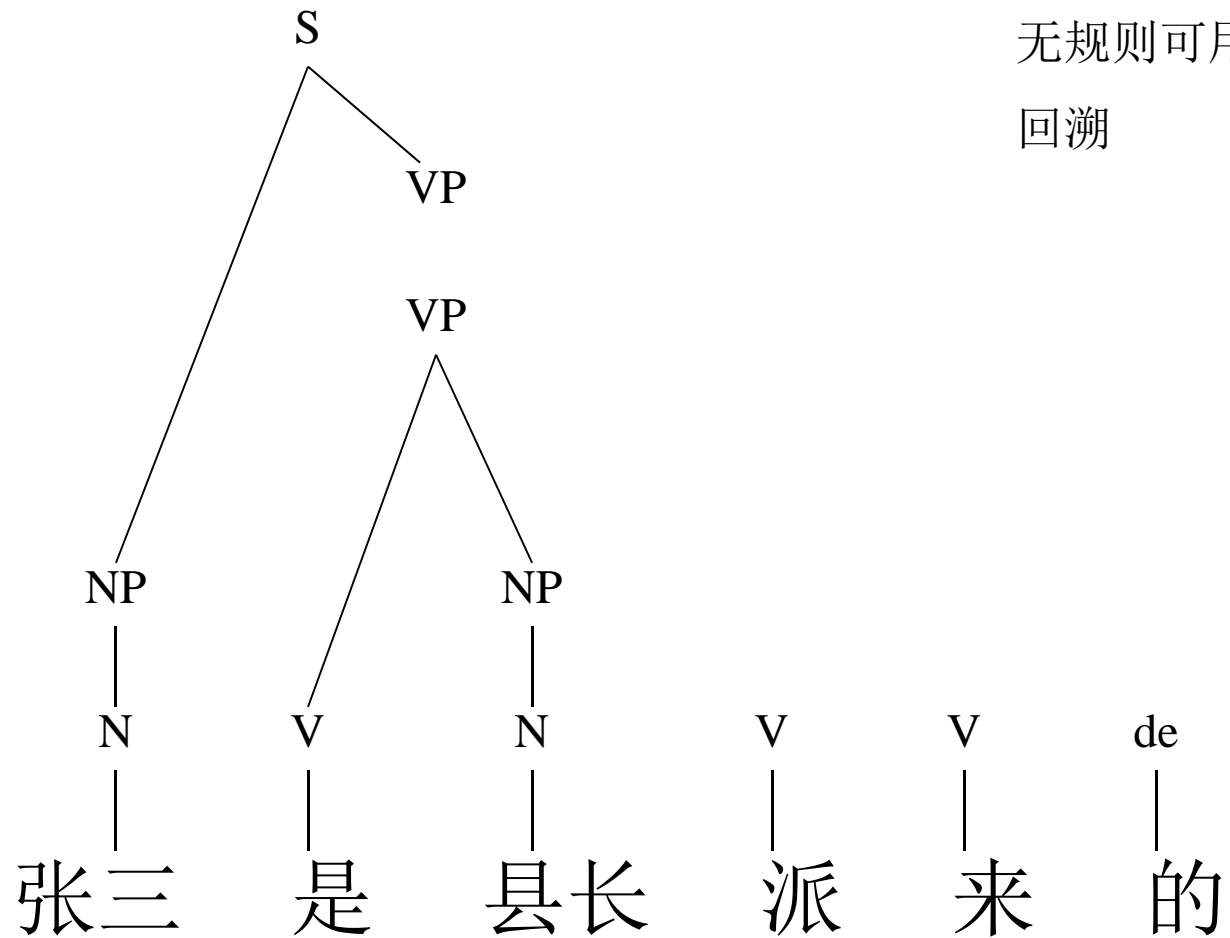
# 左角分析法示例-31

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$



# 左角分析法示例-32

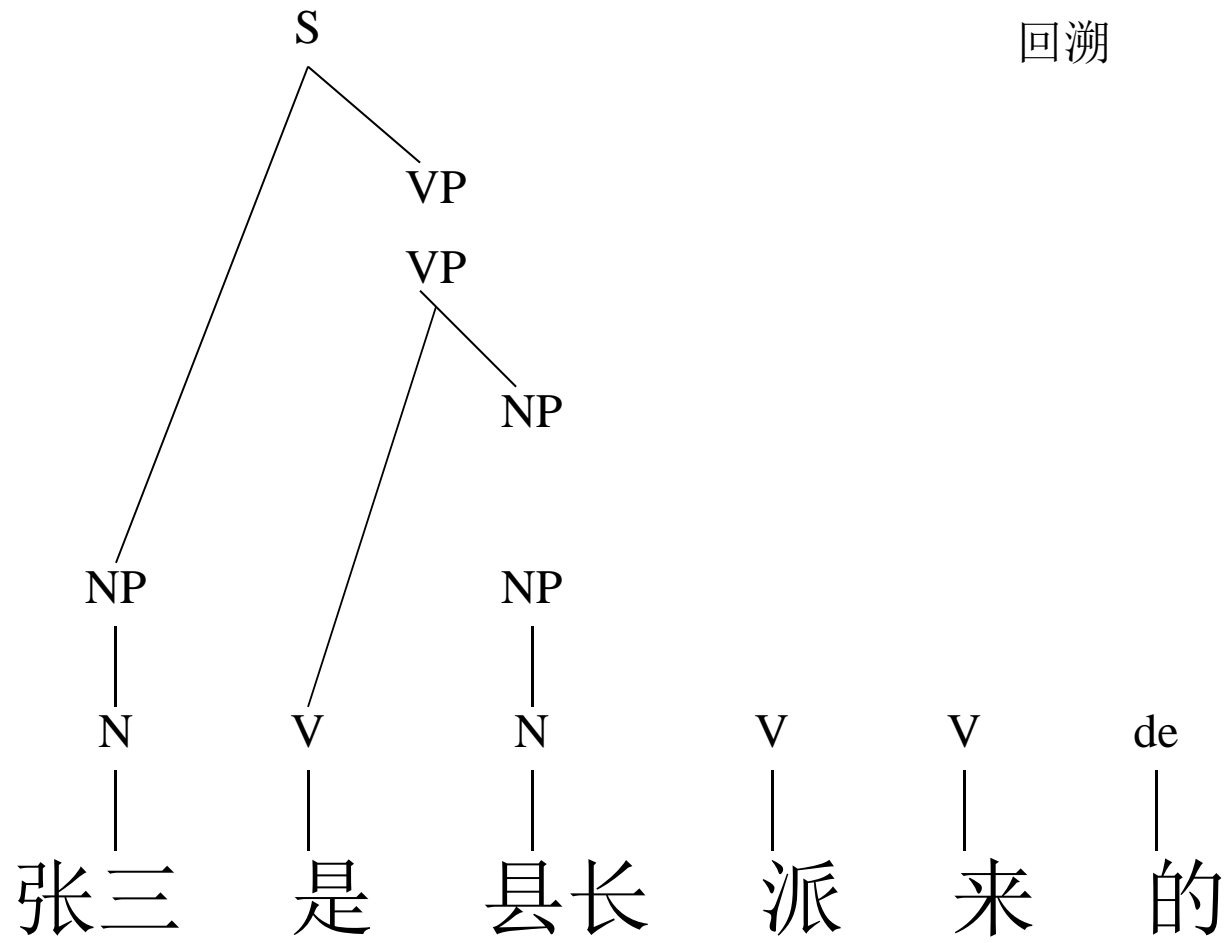
- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$



# 左角分析法示例-33

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

回溯

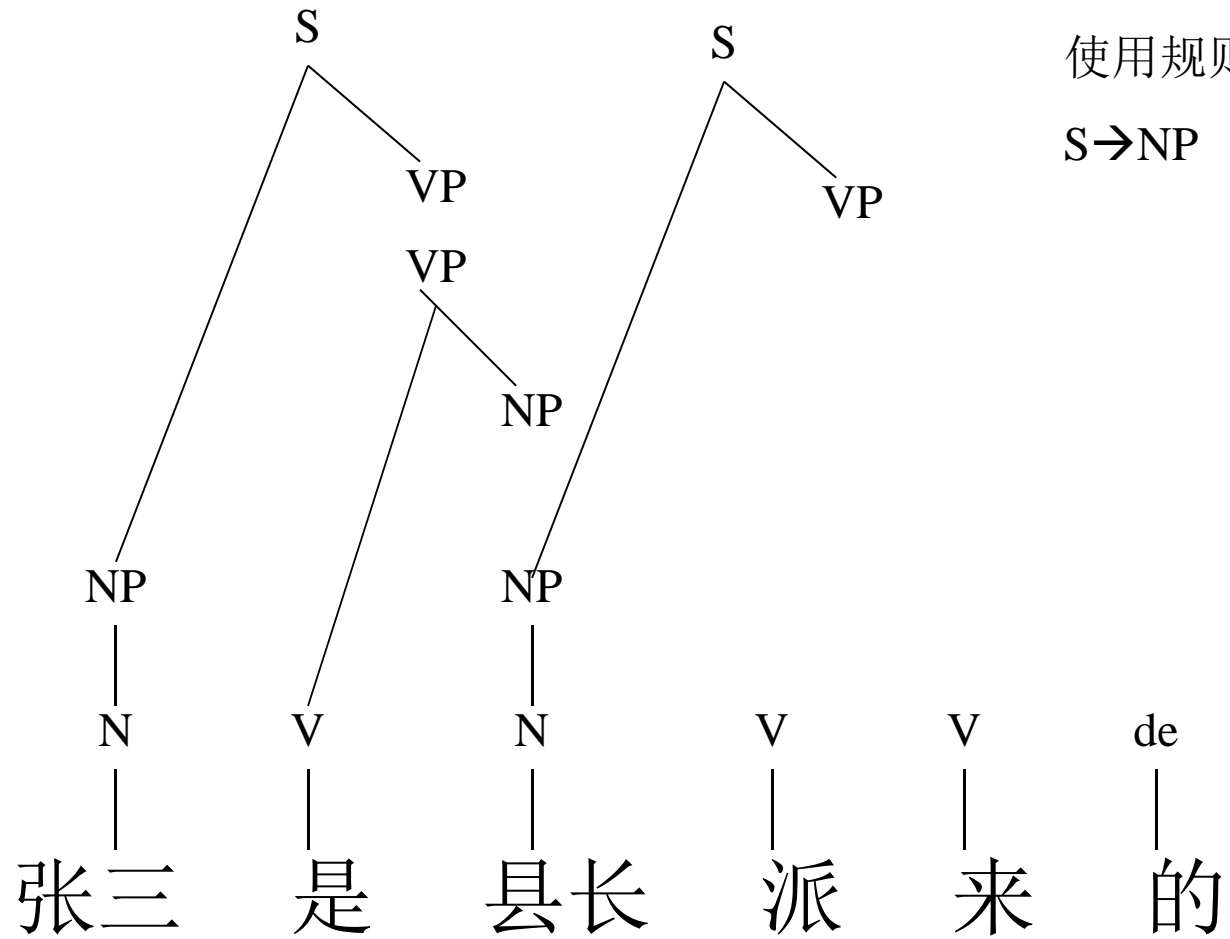


# 左角分析法示例-34

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

使用规则

$S \rightarrow NP VP$

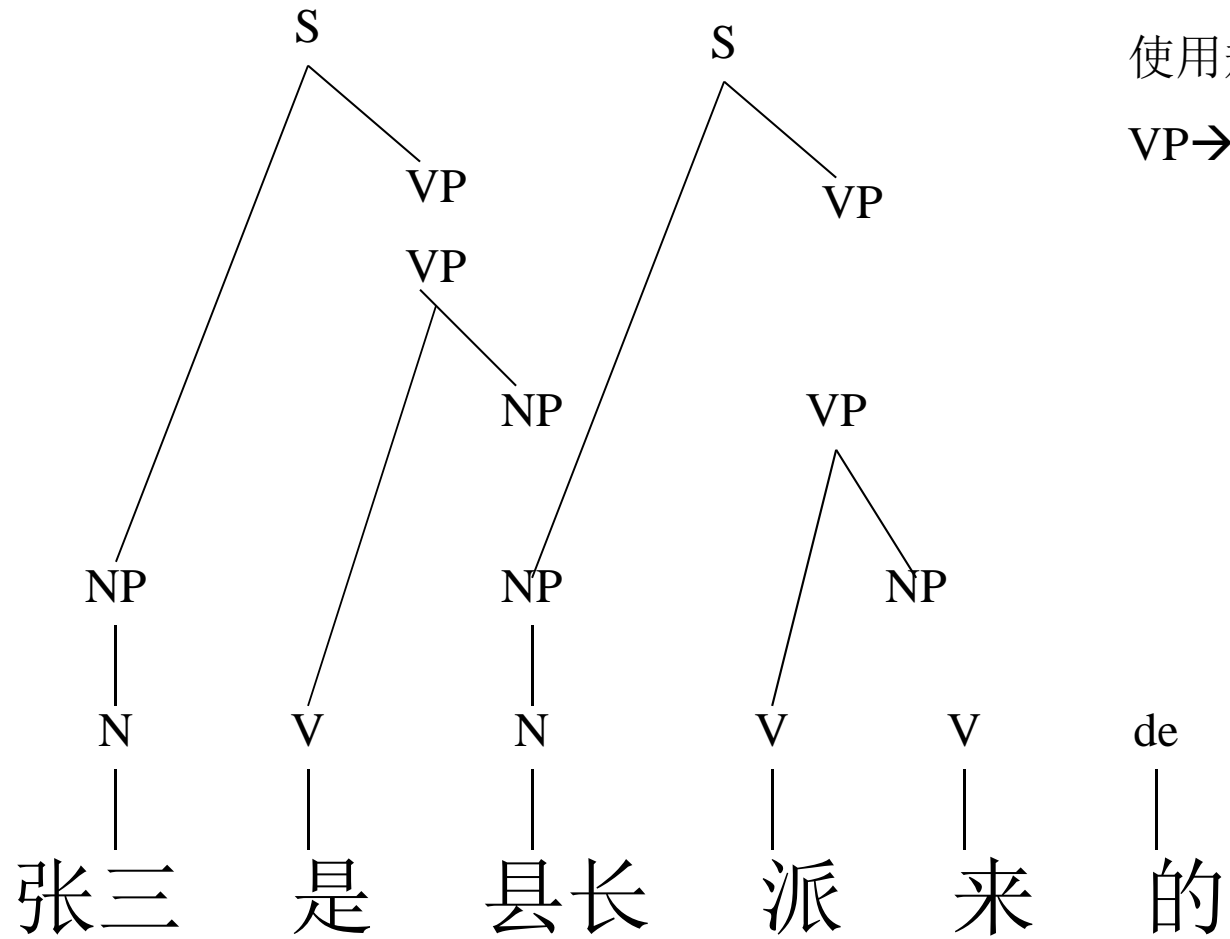


# 左角分析法示例-35

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

使用规则:

$VP \rightarrow V NP$

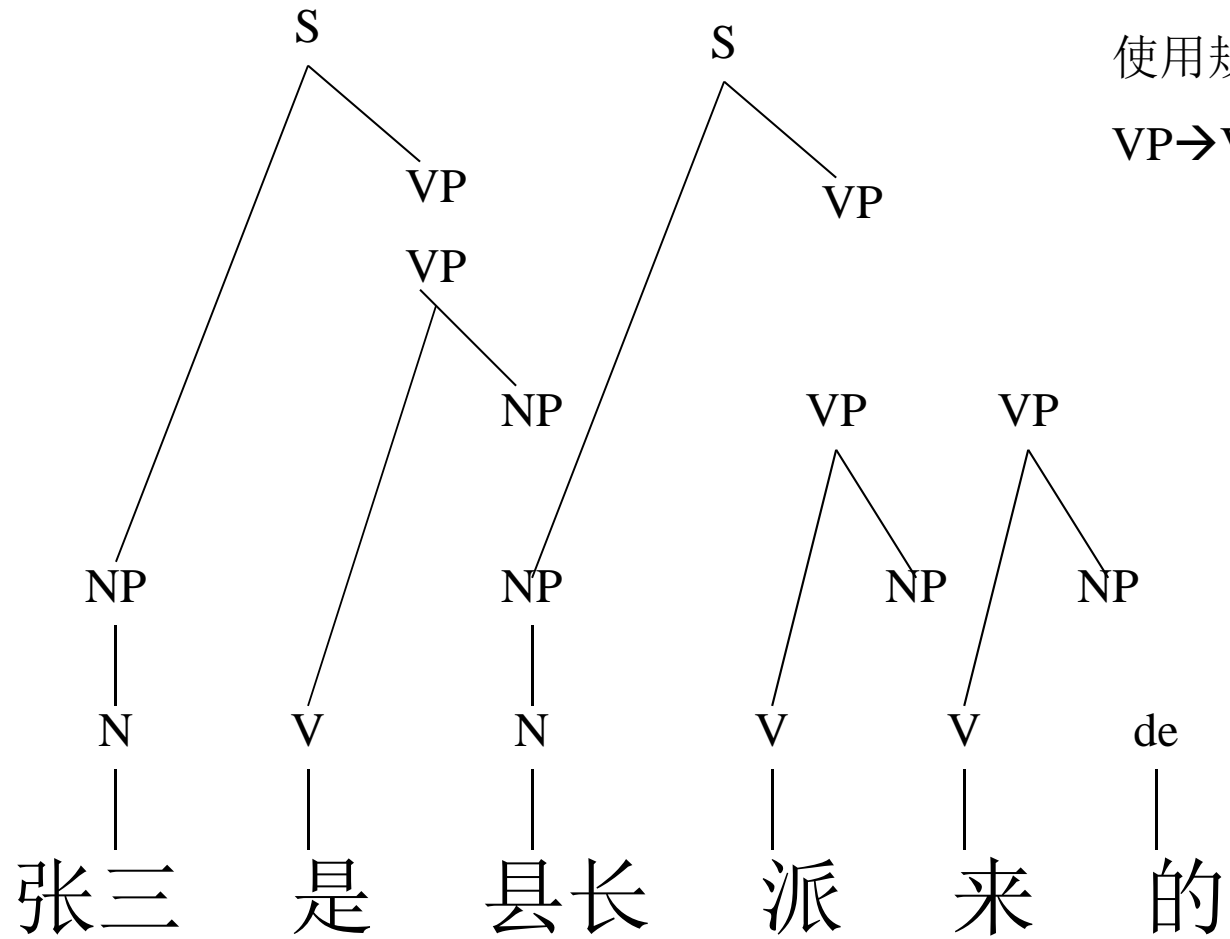


# 左角分析法示例-36

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

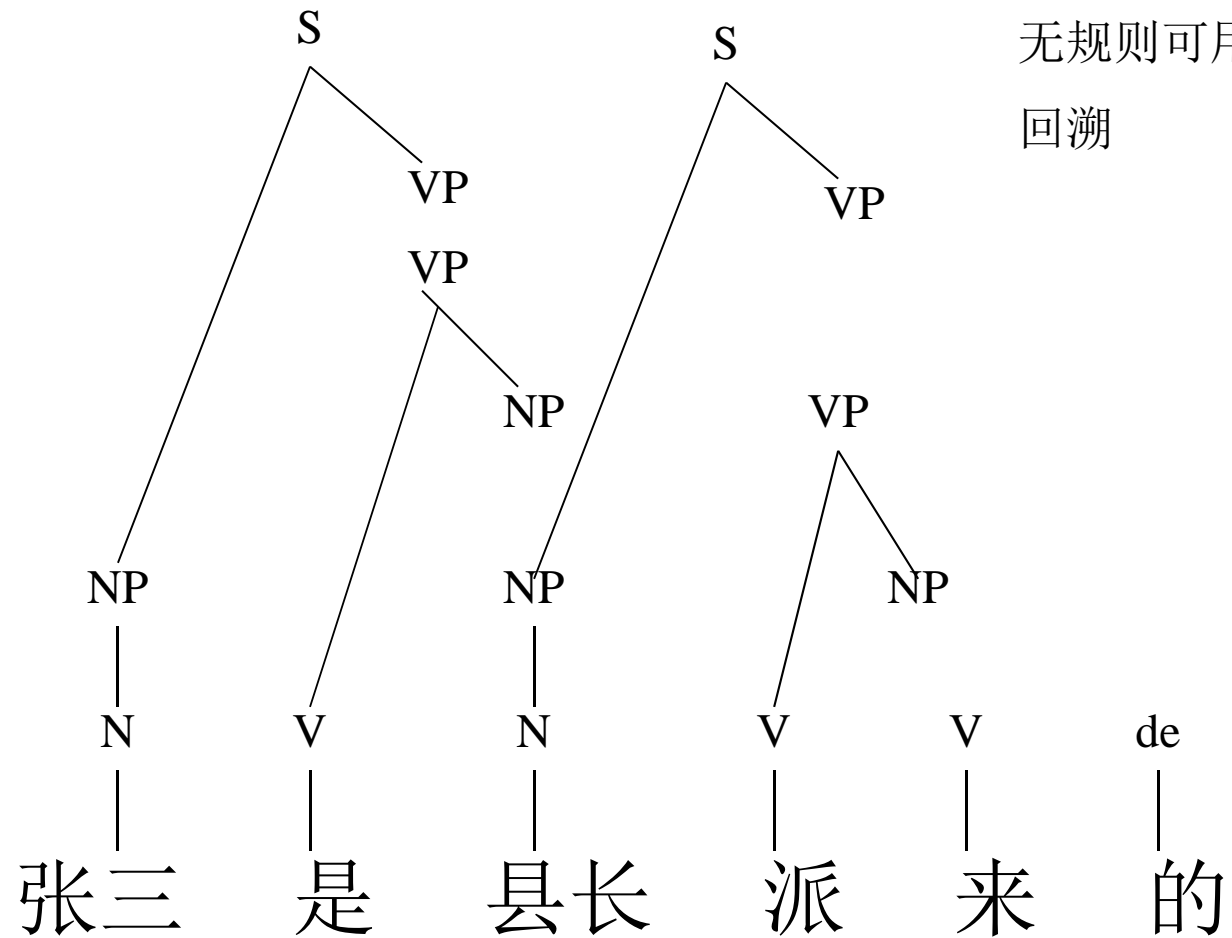
使用规则:

$VP \rightarrow V NP$



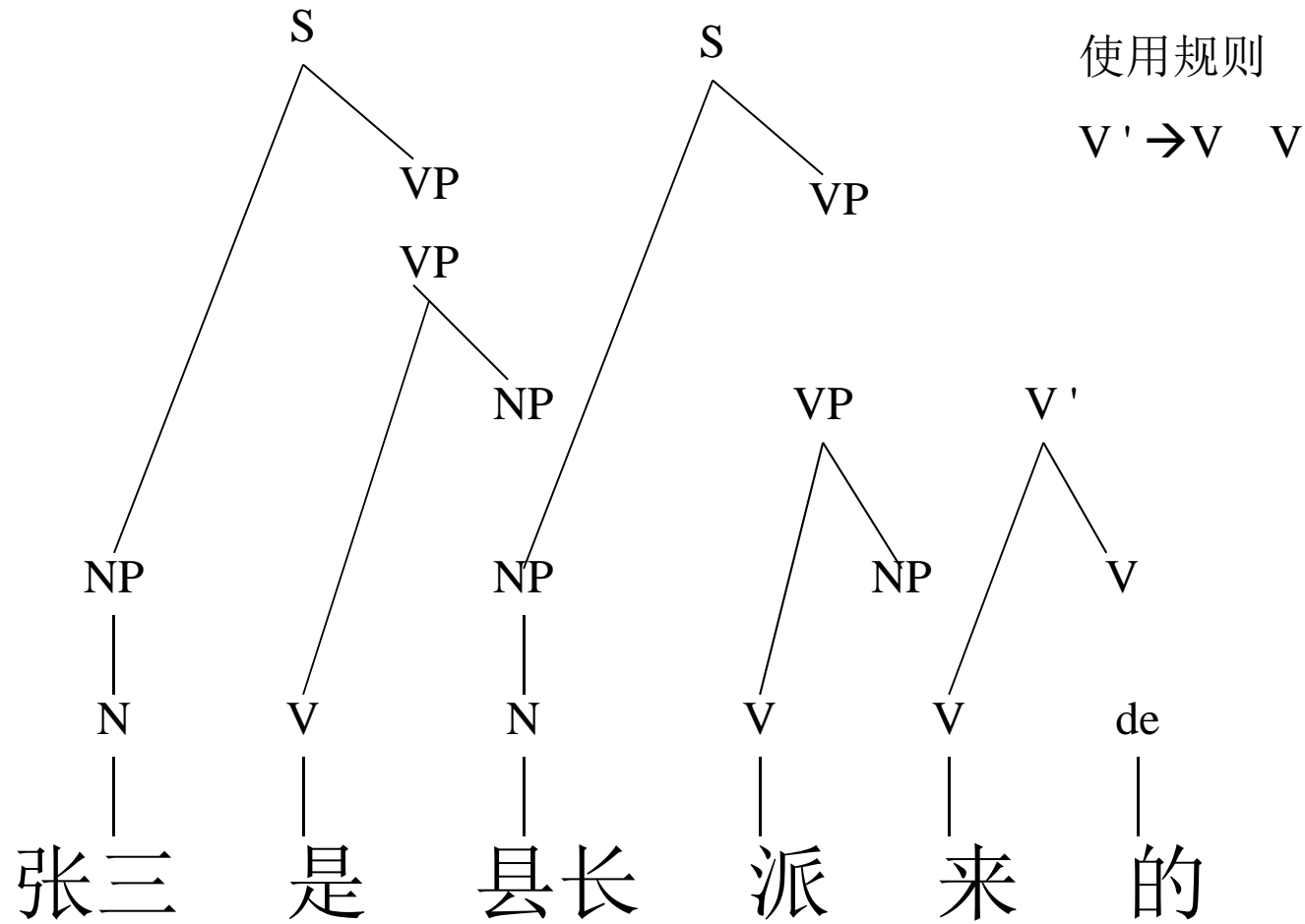
# 左角分析法示例-37

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$



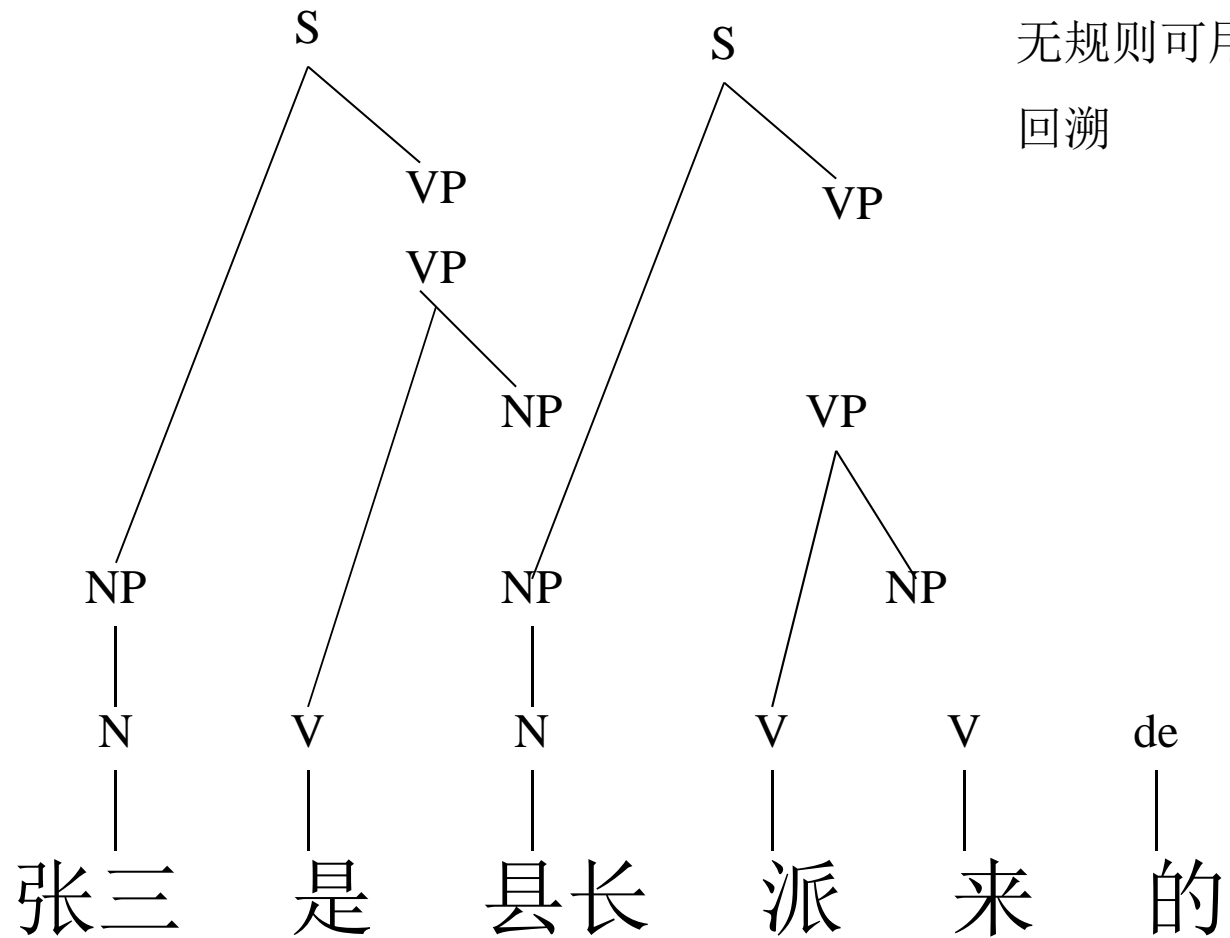
# 左角分析法示例-38

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$



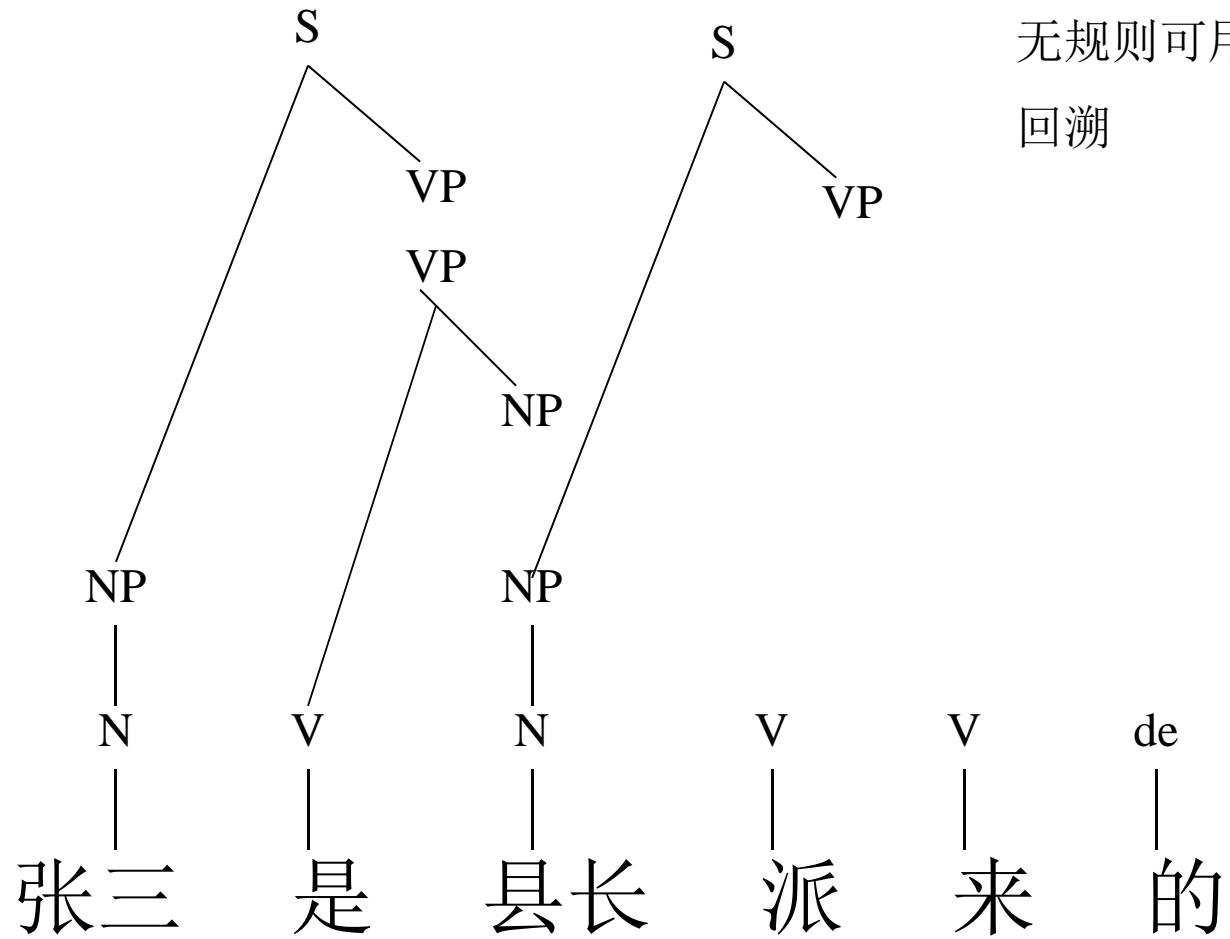
# 左角分析法示例-39

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$



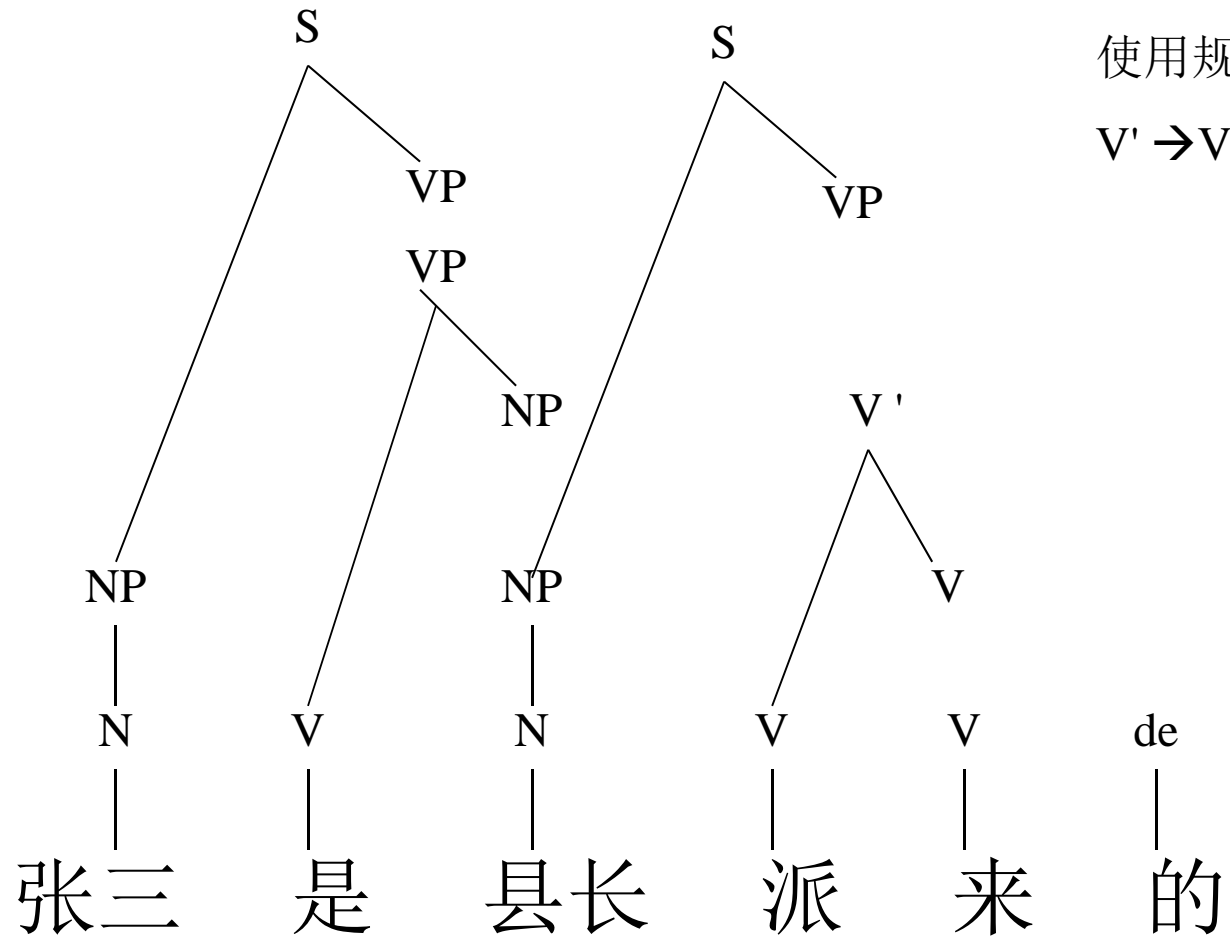
# 左角分析法示例-40

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$



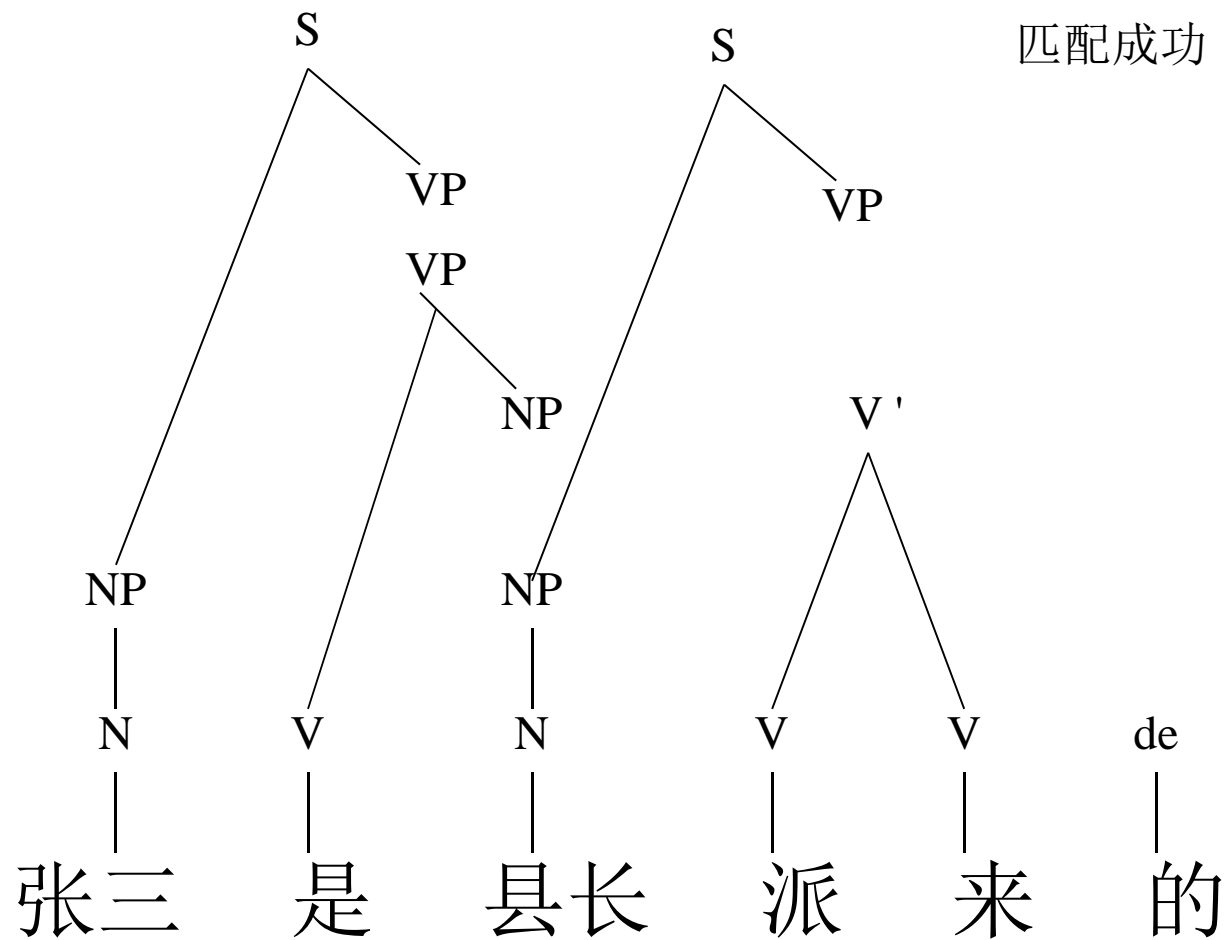
# 左角分析法示例-41

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$



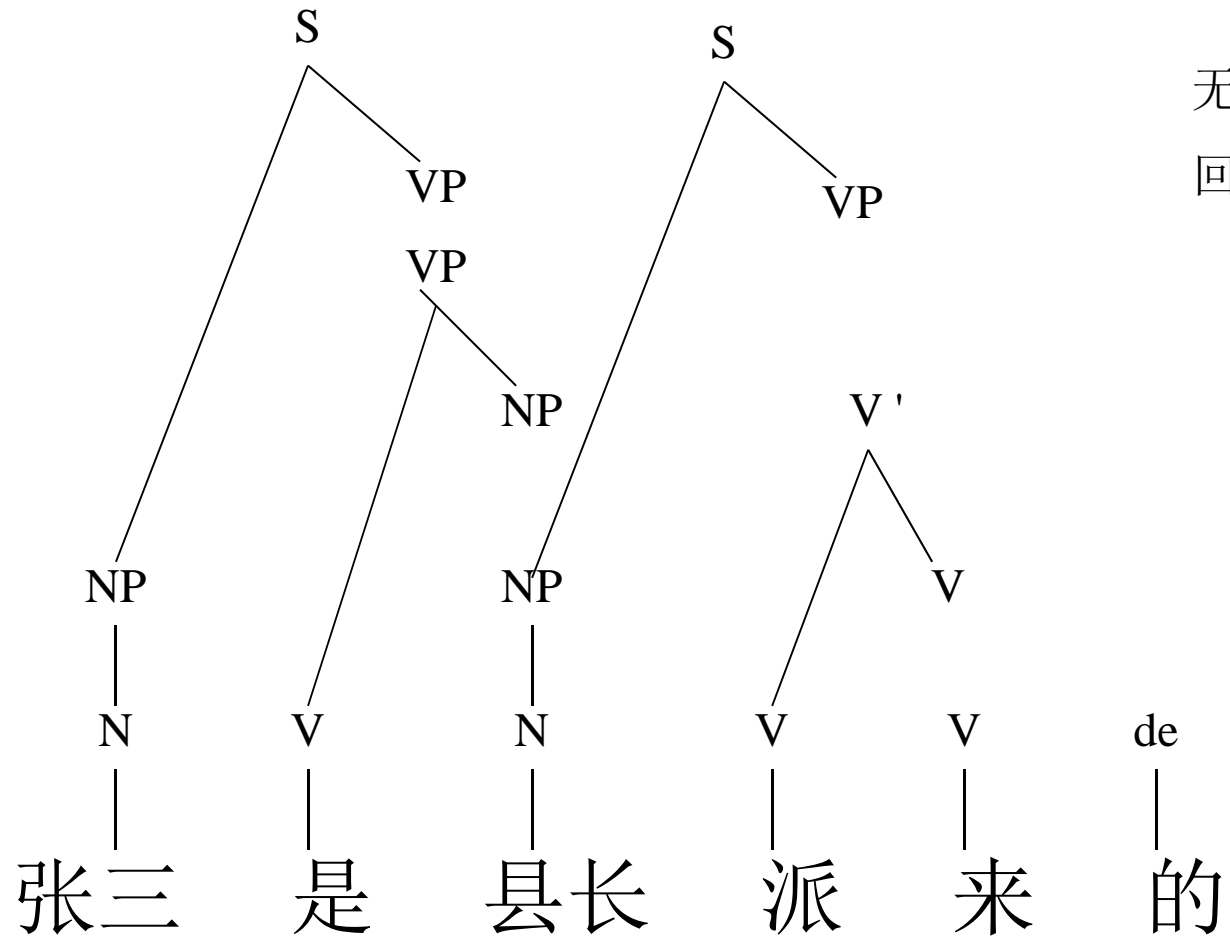
# 左角分析法示例-42

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$



# 左角分析法示例-43

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

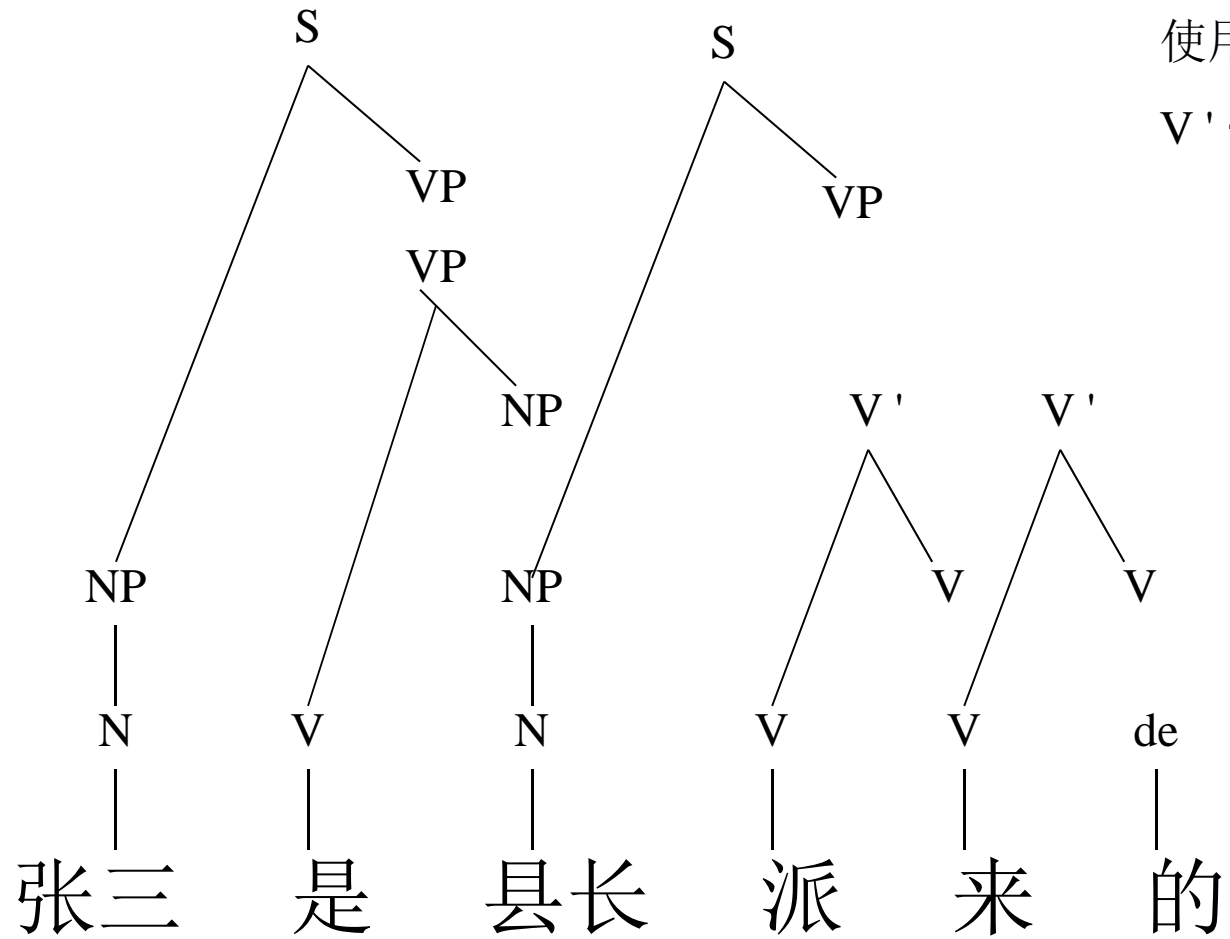


无规则可用

回溯

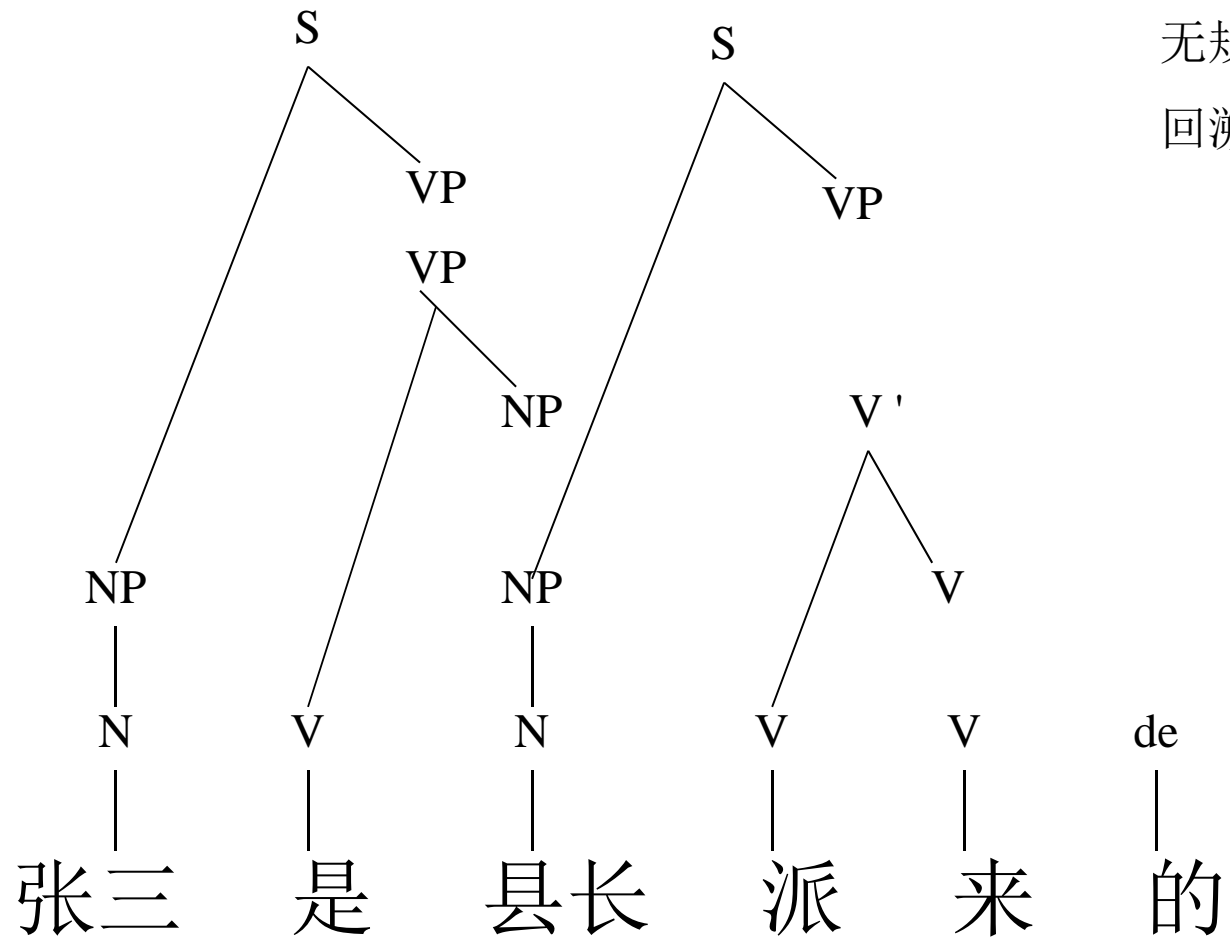
# 左角分析法示例-44

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$



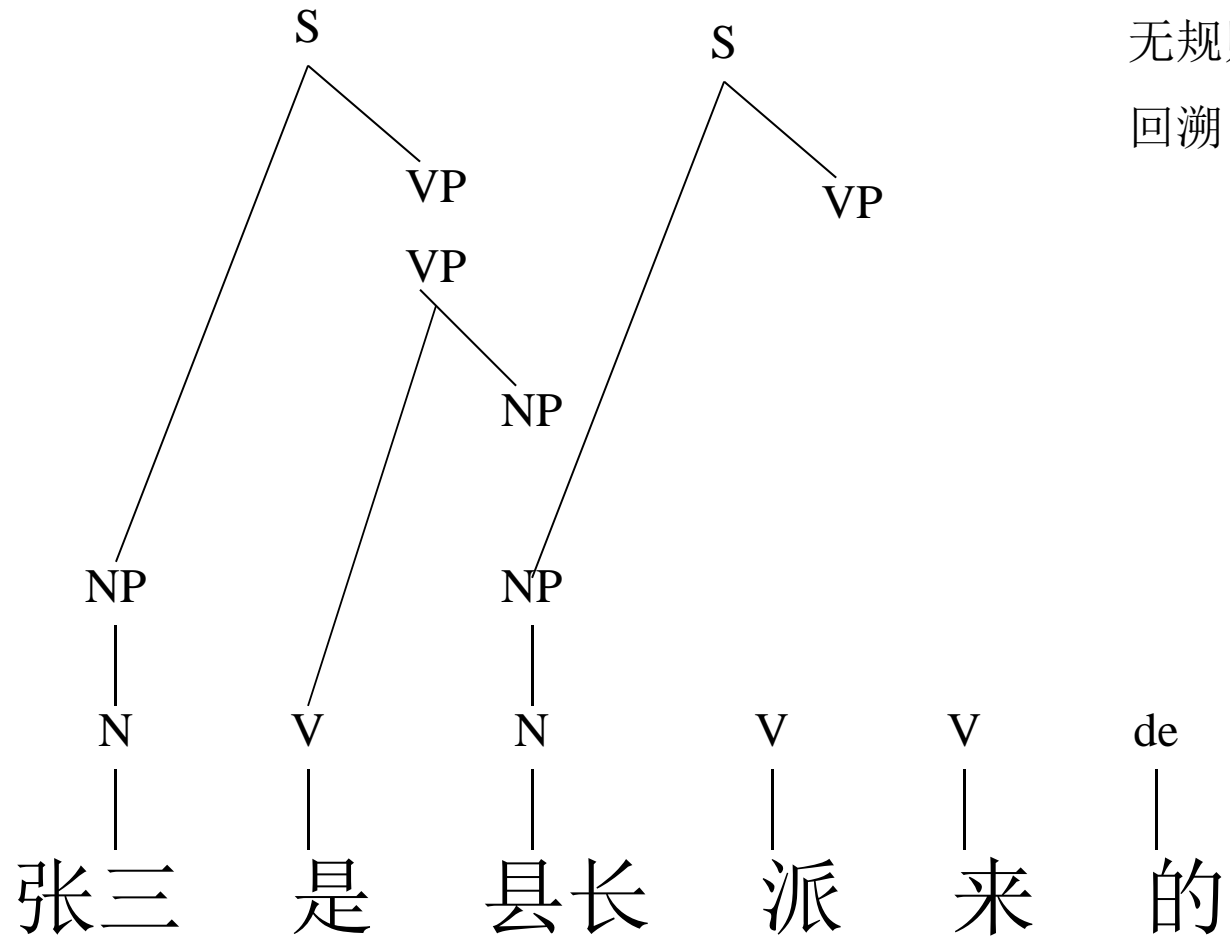
# 左角分析法示例-45

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$



# 左角分析法示例-46

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

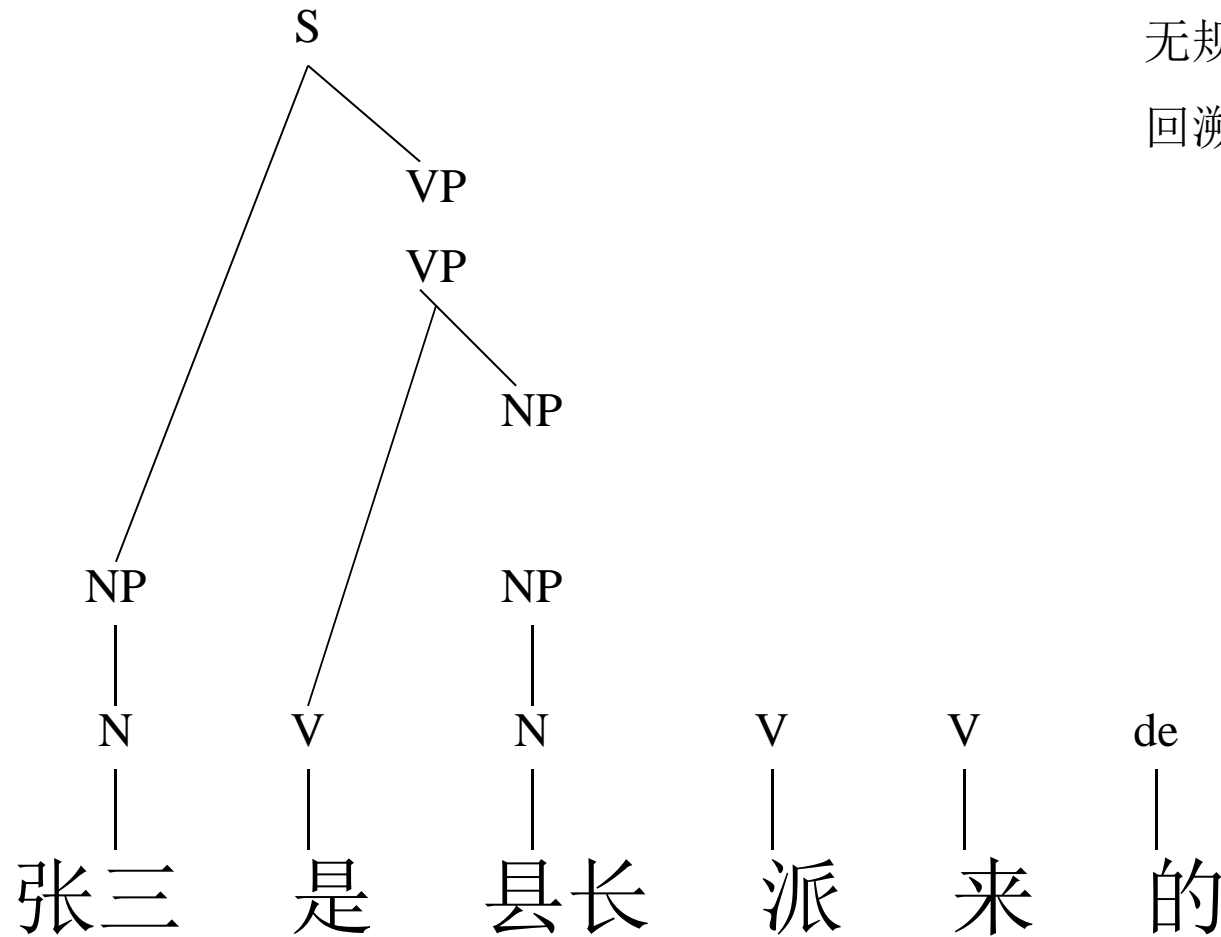


# 左角分析法示例-47

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

无规则可用

回溯

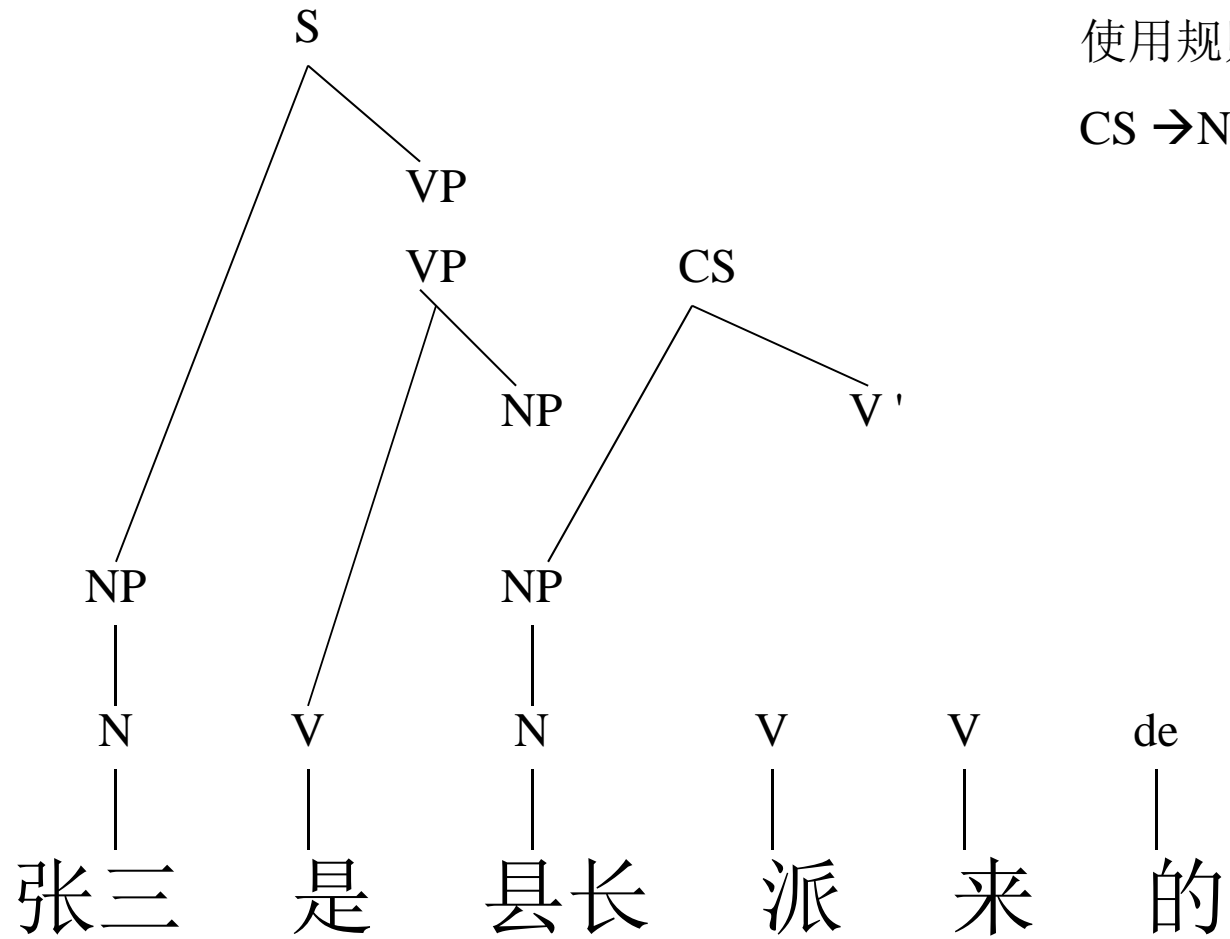


# 左角分析法示例-48

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

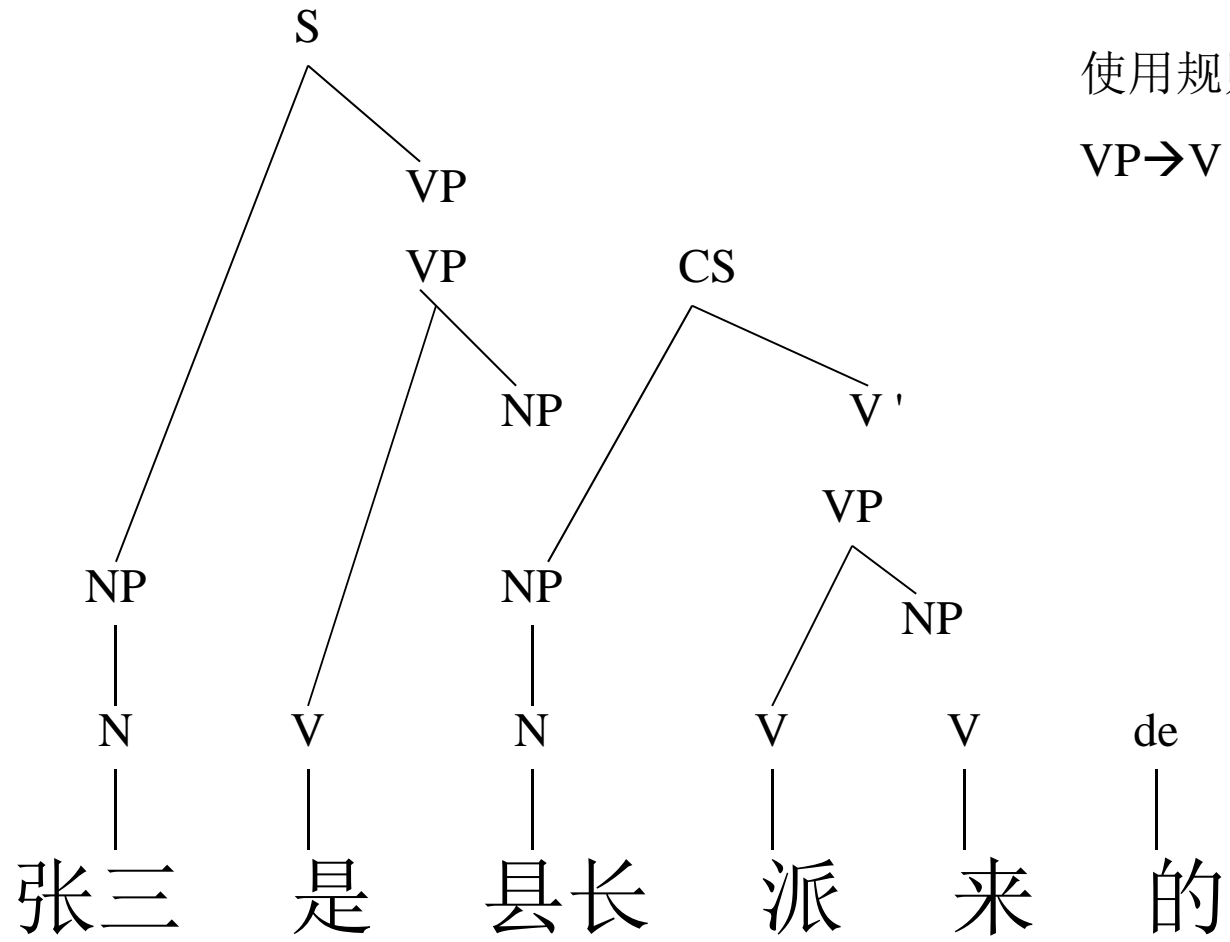
使用规则:

$CS \rightarrow NP V'$



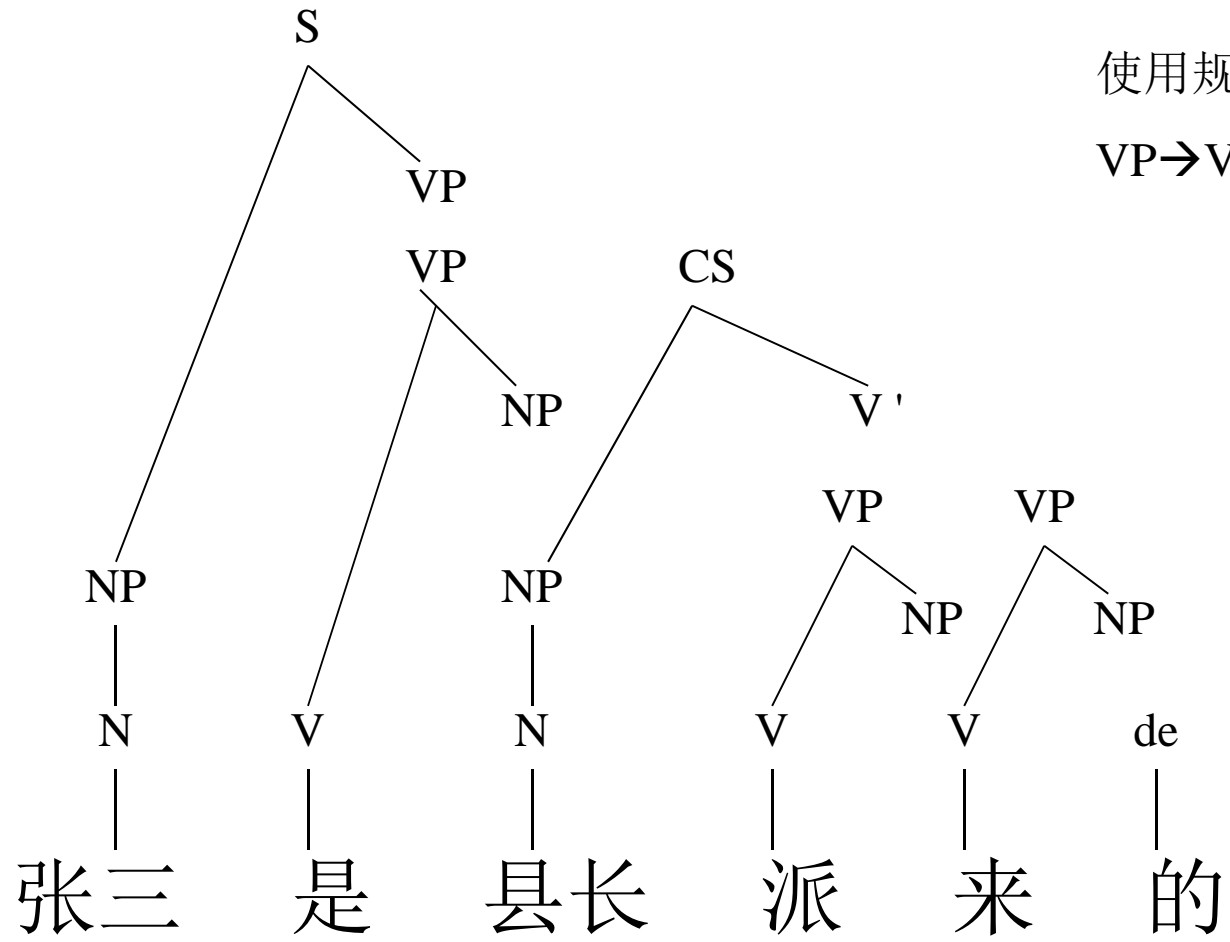
# 左角分析法示例-49

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$



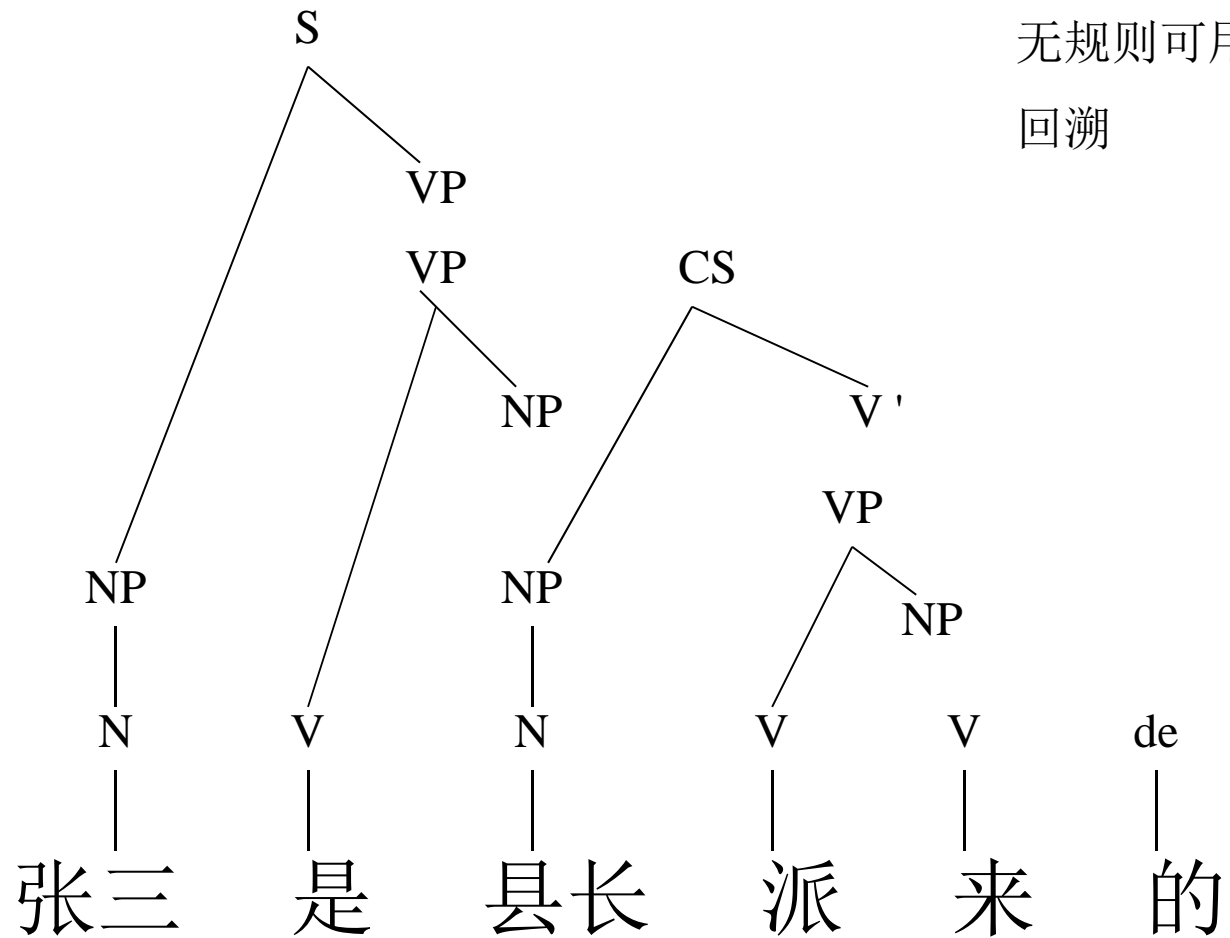
# 左角分析法示例-50

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$



# 左角分析法示例-51

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

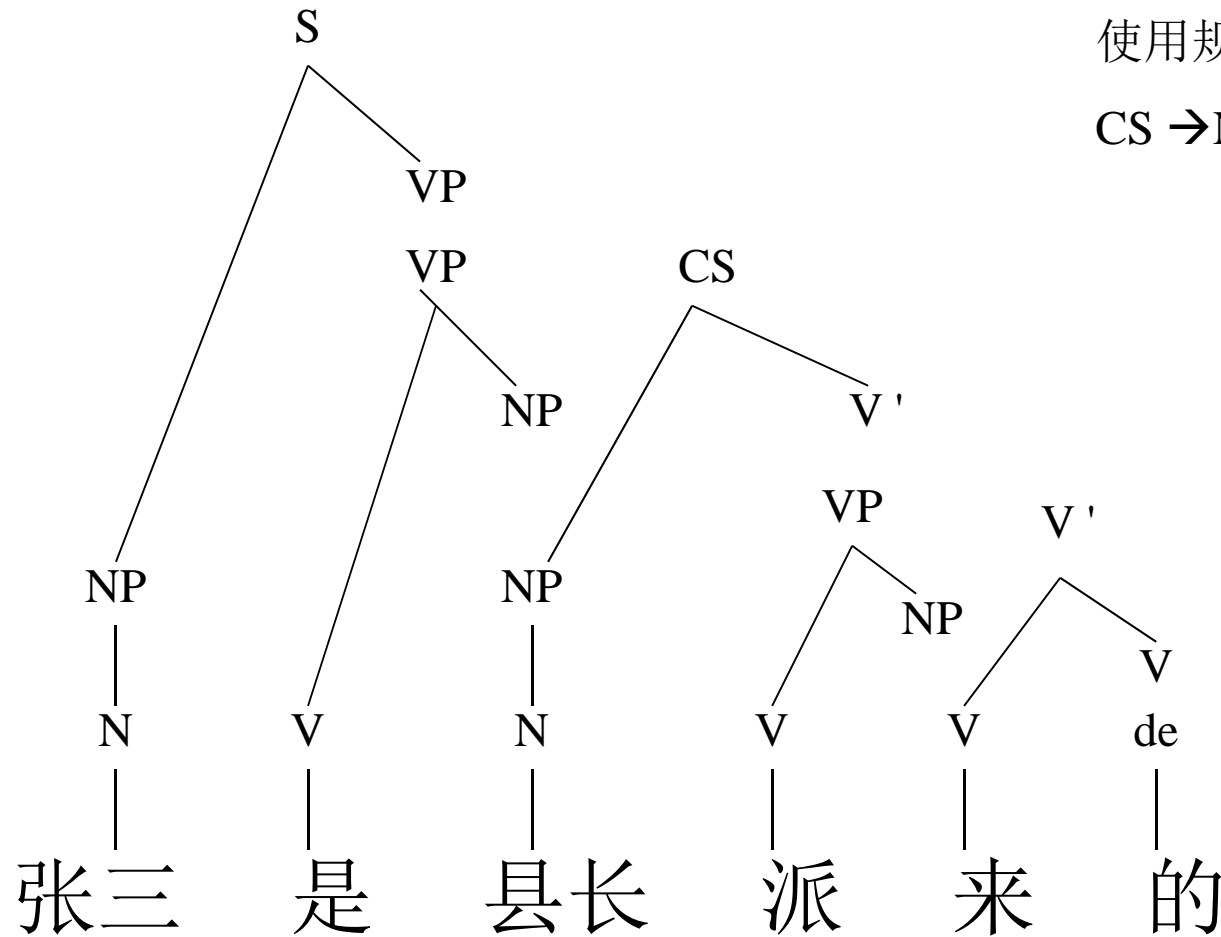


# 左角分析法示例-52

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

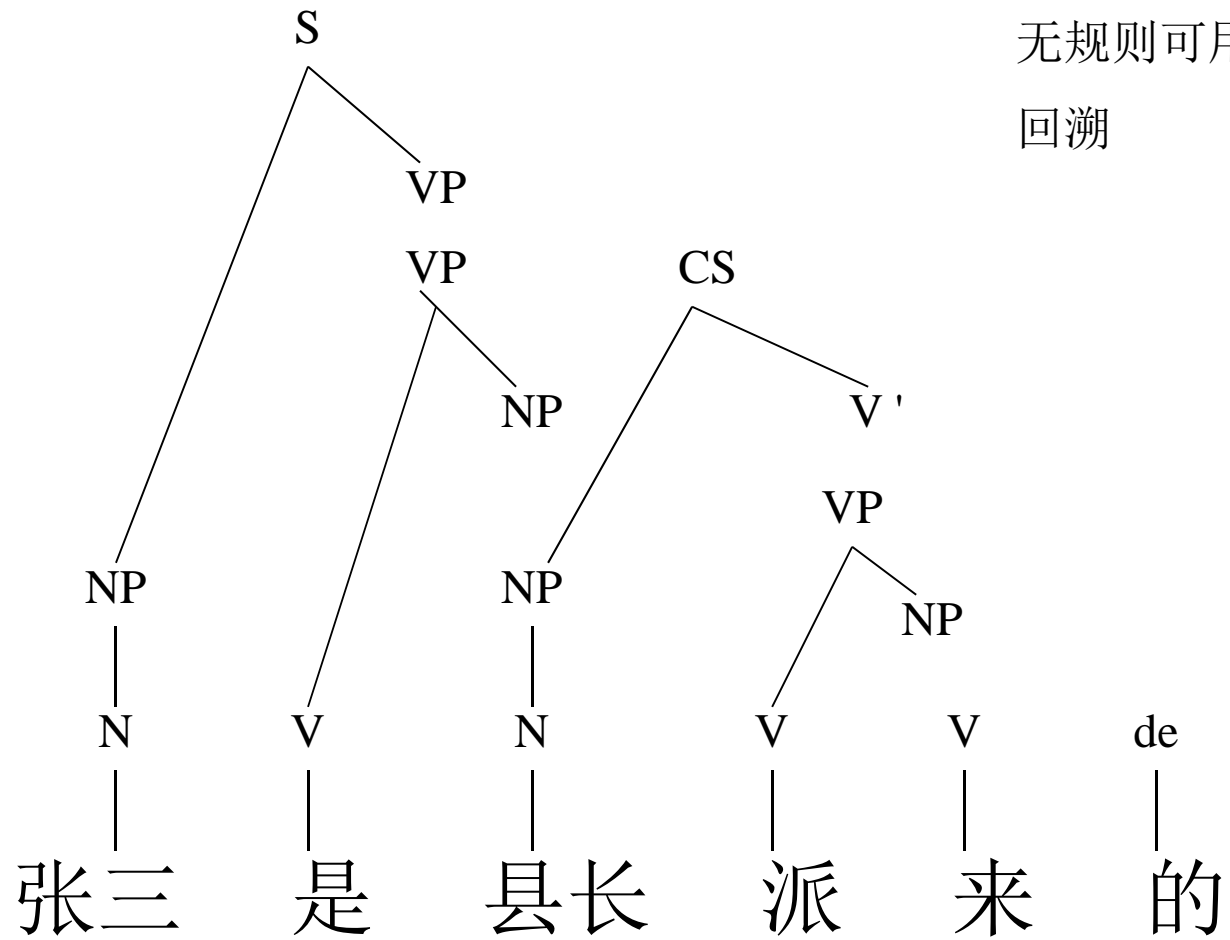
使用规则:

$CS \rightarrow NP V'$



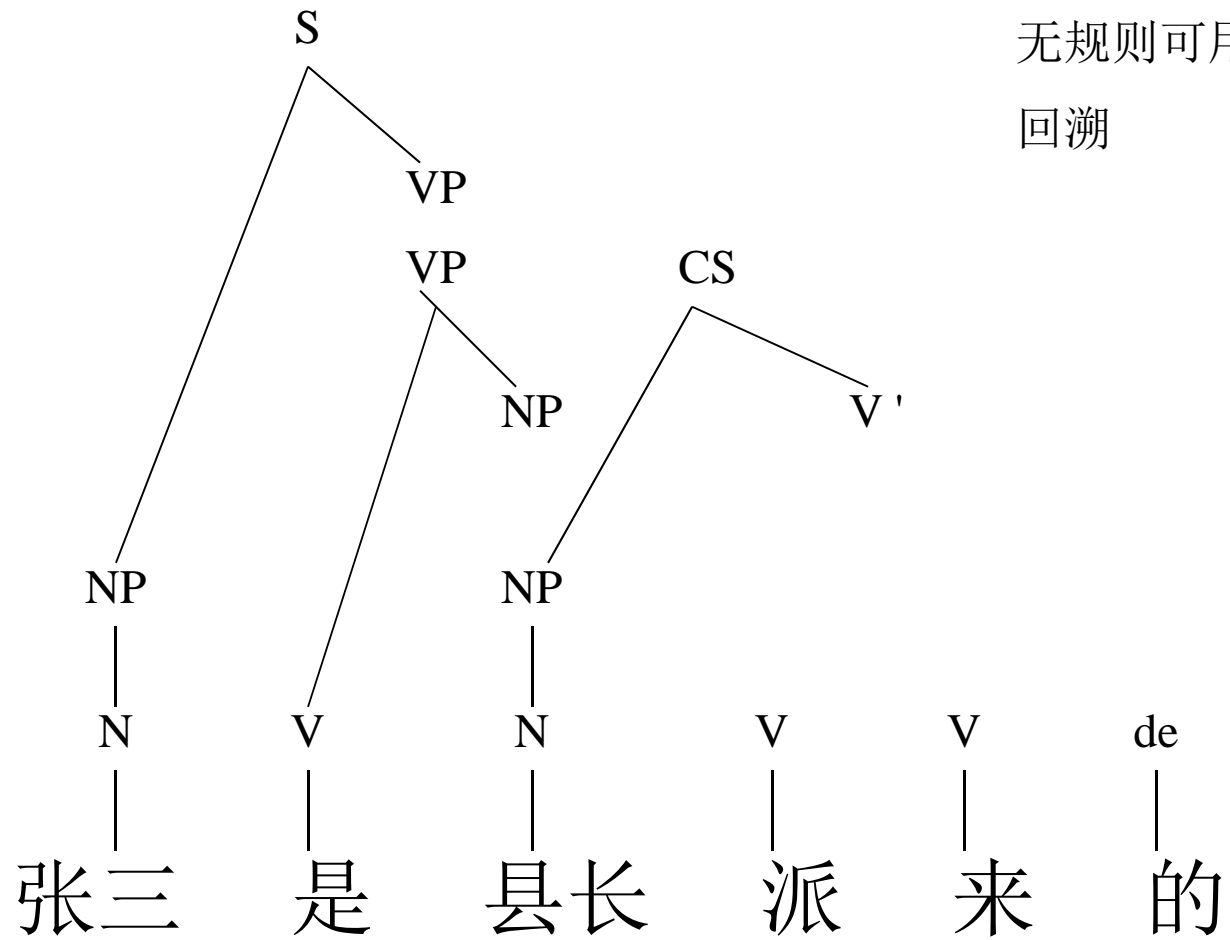
# 左角分析法示例-53

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$



# 左角分析法示例-54

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

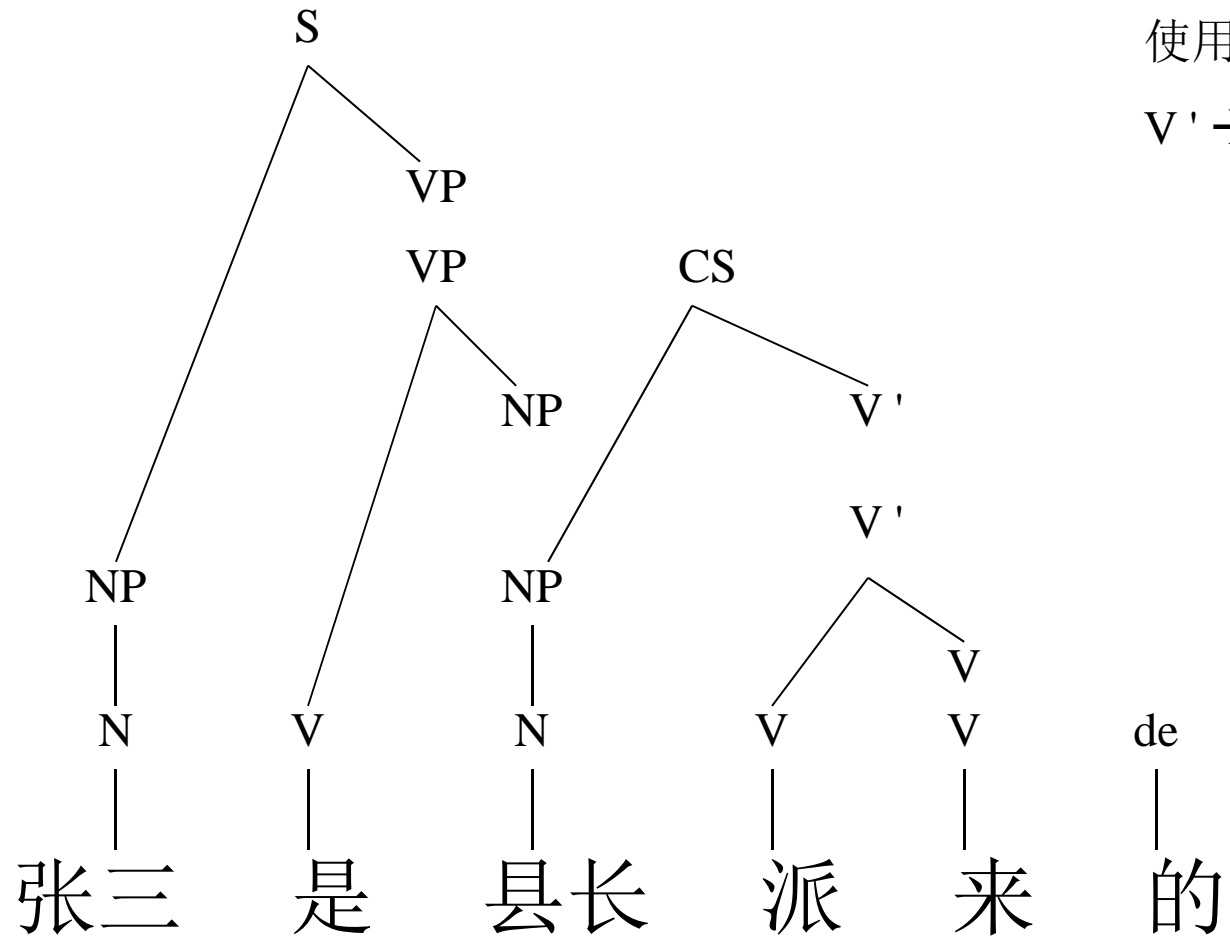


# 左角分析法示例-55

- (1)  $S \rightarrow NP \ VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS \ 的$
- (4)  $CS \rightarrow NP \ V'$
- (5)  $VP \rightarrow V \ NP$
- (6)  $V' \rightarrow V \ V$

使用规则:

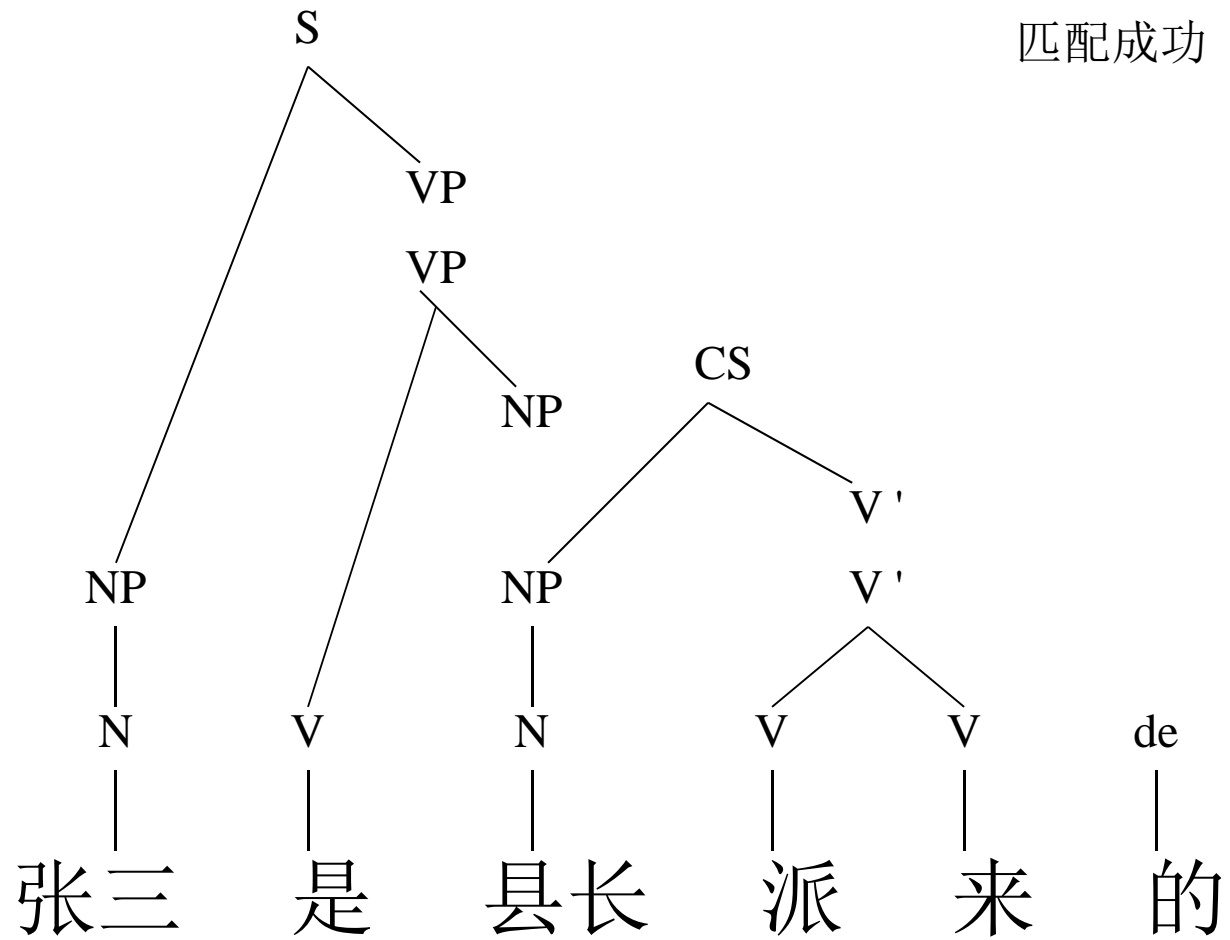
$V' \rightarrow V \ V$



# 左角分析法示例-56

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

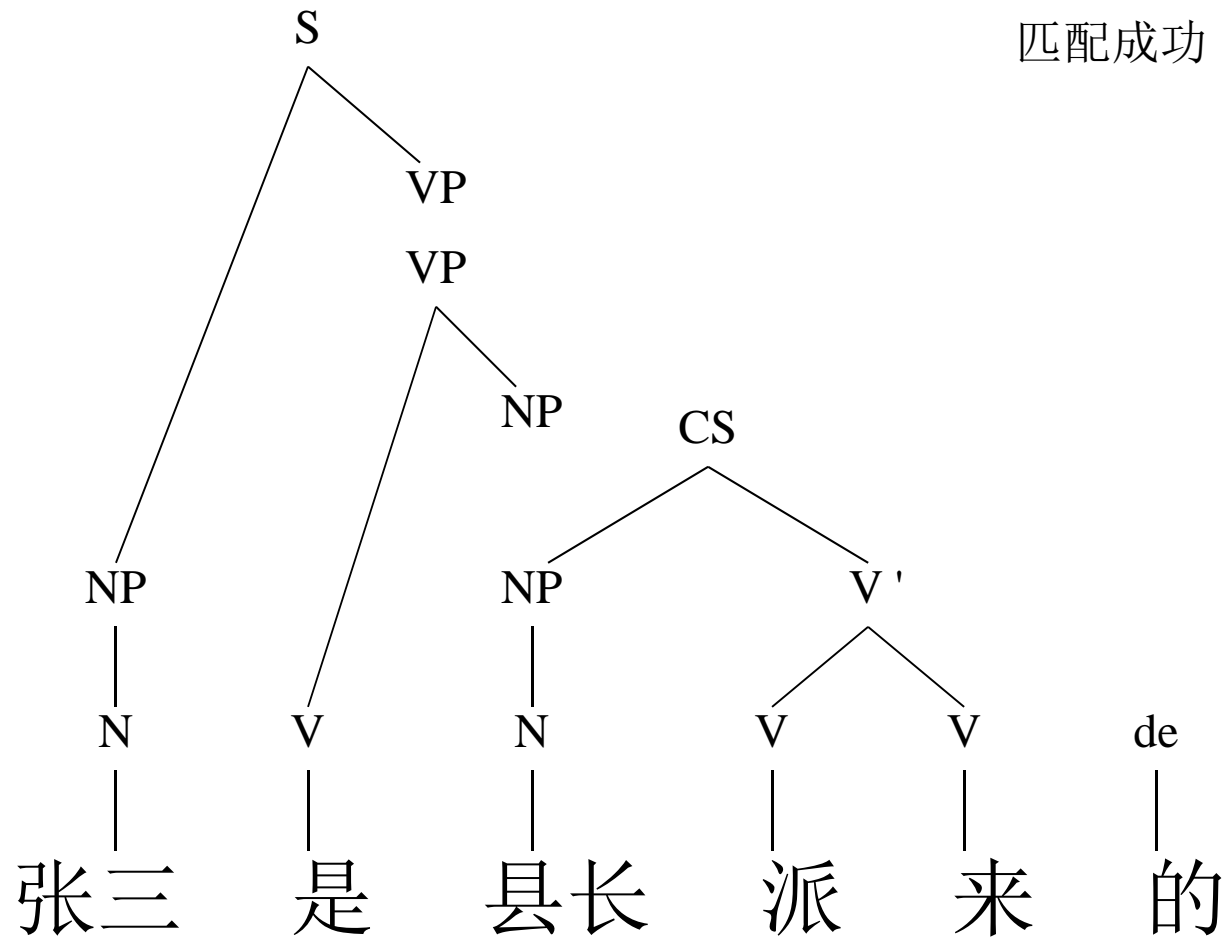
匹配成功



# 左角分析法示例-57

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

匹配成功

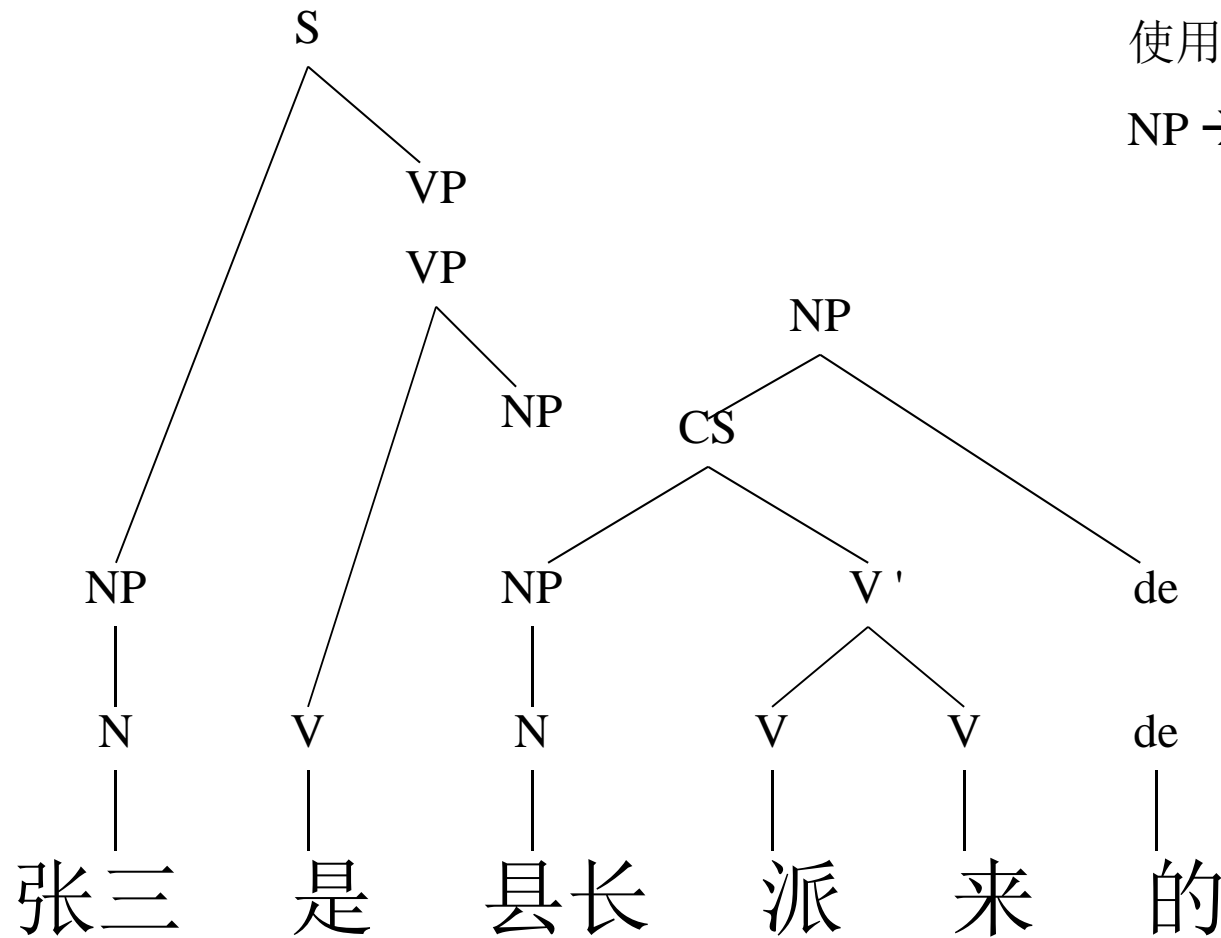


# 左角分析法示例-58

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

使用规则:

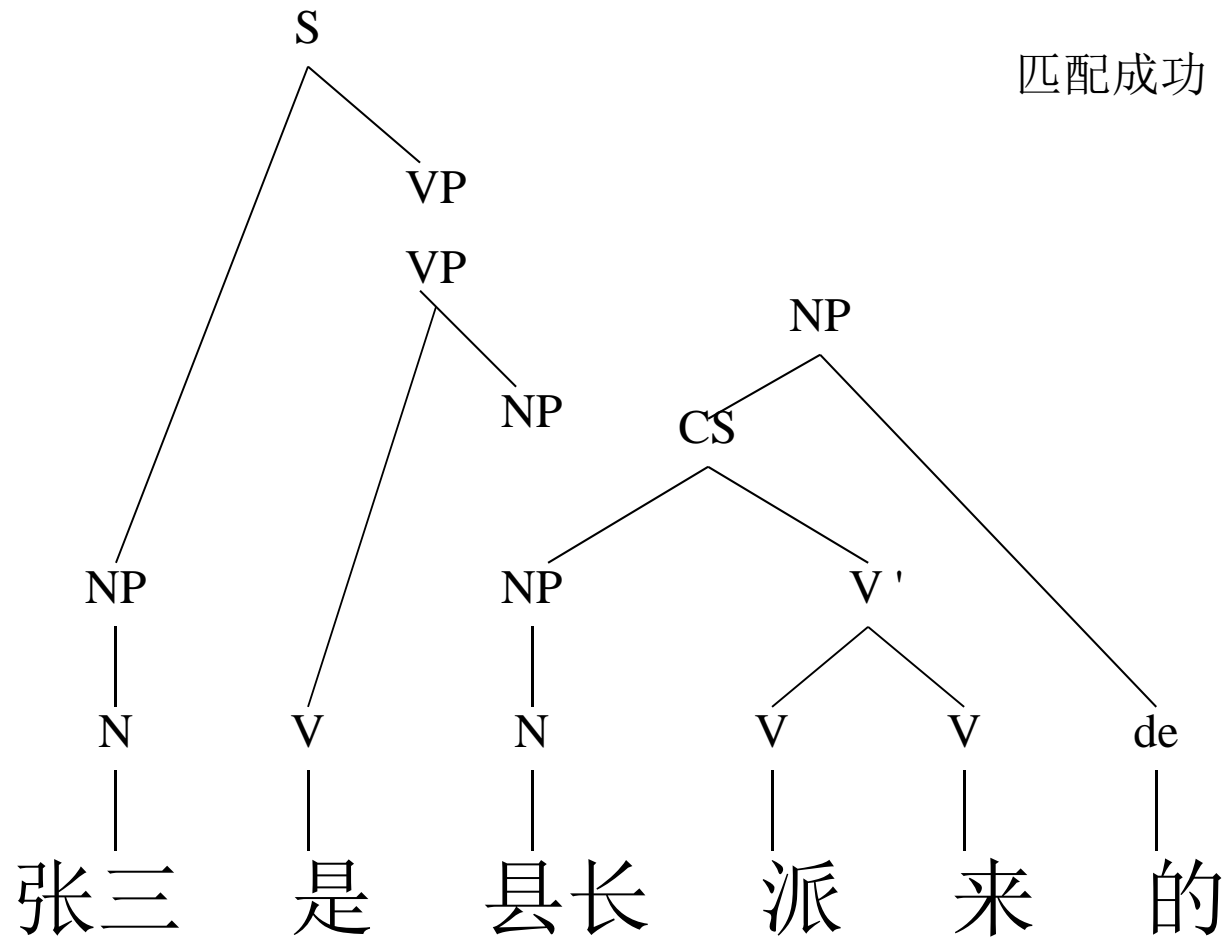
$NP \rightarrow CS$  de



# 左角分析法示例-59

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

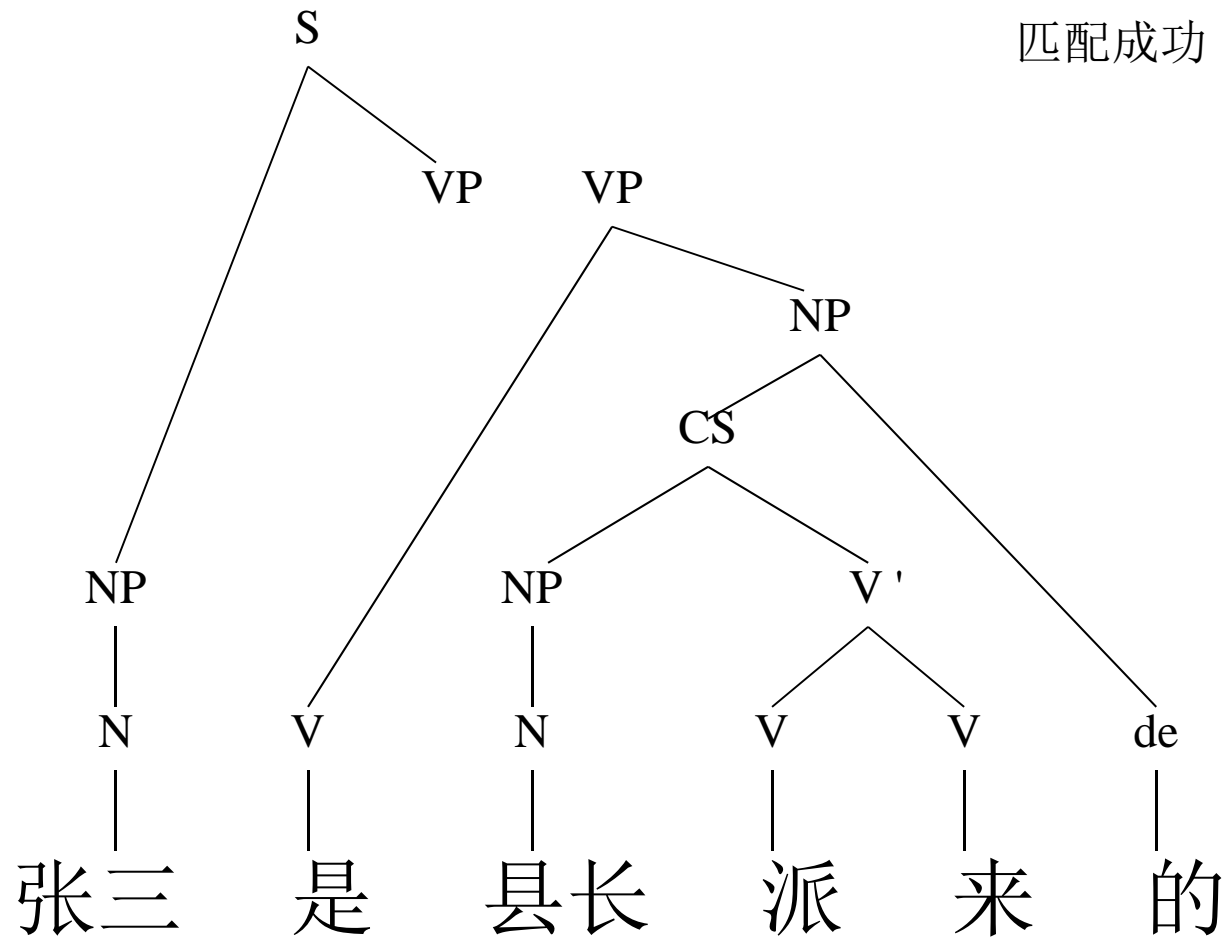
匹配成功



# 左角分析法示例-60

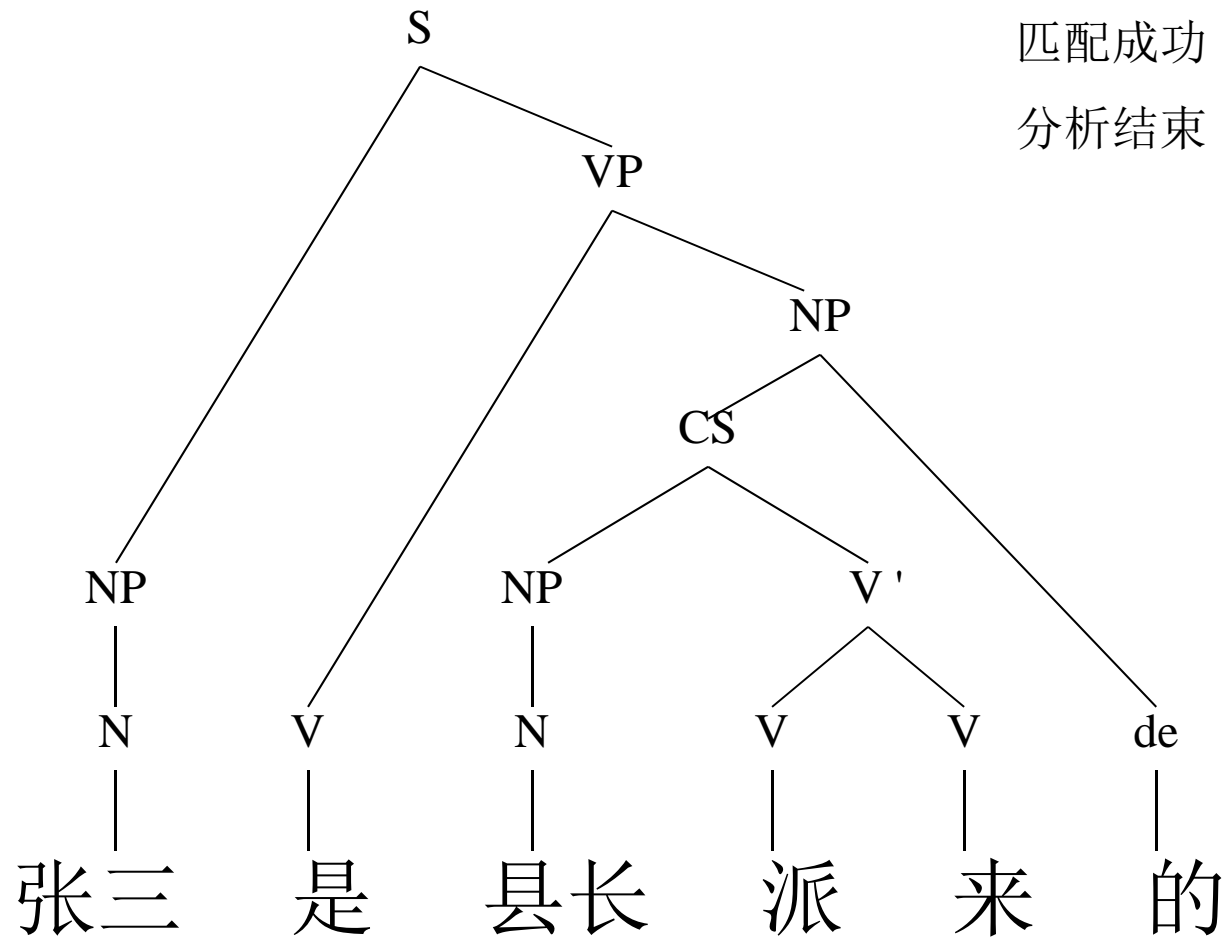
- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$

匹配成功



# 左角分析法示例-61

- (1)  $S \rightarrow NP VP$
- (2)  $NP \rightarrow N$
- (3)  $NP \rightarrow CS$  的
- (4)  $CS \rightarrow NP V'$
- (5)  $VP \rightarrow V NP$
- (6)  $V' \rightarrow V V$



# 关于左角分析法的思考

回溯过多，对这个例子来说，是由于深度优先，一开始走错了，以后步步皆错，要回溯到一开始的地方，才能重新走回到正确的道路上，分析效率很低。