Syntactic anomaly beyond semantic rescue: Processing NVN garden path sentences in Mandarin Chinese

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The best known sentence in the garden-path literature (Bever, 1970)

- The horse raced past the barn ----.
The best known sentence in the garden-path literature (Bever, 1970)

- The horse raced past the barn fell.
Goals

- To examine the processing strategy underlying *The horse raced past the barn fell* by studying its counterpart in Chinese.

- To discuss syntactic misparses and reanalyzability in on-line sentence comprehension
  - How syntactic structures are constructed on-line
  - How semantic interpretation is reached
  - What happens when the syntax is misleading
  - Can semantics help?
More general research questions

- When do we construct syntactic structures?
- Does semantic information contribute to the processing of sentences that involve syntactic garden path?  
  \textit{NOT initially}
Outline

- **Pseudo-syntax**: the canonical sentence templates (NVN) as a processing strategy (Bever, 1970; Townsend & Bever, 2001)
- **Incremental Minimalist Parser--IMP** (Lin, 2006)
- Experiment (**object topicalization** in a RC)
- Discussion
The best known sentence in the garden-path literature (Bever, 1970)

- The horse raced past the barn fell.
- The classes scheduled for next Tuesday are canceled.
Issues raised by this sentence

The horse raced past the barn fell.

- Structural misparse & semantic misinterpretation
- Difficulty of reanalysis
- Syntactic versus semantic processes
NVN sequences (Bever, 1970)

- Tend to be taken as Subject-Verb-Object
- Then interpreted as Agent-Action-Patient

Question:

How strong is this top-down templatic dominance?

Does syntax come earlier than semantics?
Syntax > Semantics (serial)

Syntax ~ Semantics (parallel)

e.g. animacy
main-clause analysis

N  V  N

The horse raced past the barn fell.

Theme (= the racer)

reduced RC analysis

Patient (= the racee)
When the 1st N is an unlikely agent

**main-clause analysis**

N V N

The evidence examined by the lawyer turned out to be unreliable.

**Patient**

**Agent**

**reduced RC analysis**

- Immediate semantic effect?
  - YES (MacDonald, 1994 & Trueswell et al., 1994)
  - NO (Ferreira and Clifton, 1986—eye tracking)
Pseudo syntax versus real syntax (Townsend & Bever, 2001)

- Late Assignment of Syntax Theory (LAST)

  Pseudo Syntax
  ("quick & dirty")

  →

  Real Syntax

  NVN strategy
Incremental Minimalist Parser
(Lin, 2006)
Incremental Computation of Syntactic Structure and Semantics in IMP

PF₁ → SS₁ → LF₁
PF₂ → SS₂ → LF₂
PF₃ → SS₂' → REANALYSIS
PFᵣ → SSᵣ → LFᵣ
Incremental Minimalist Parser

- An **NVN** sequence is preferably parsed as **Subject-Verb-Object**.
- This parsing preference is driven by **syntax**.
- **Semantic** (LF) interpretation of **Agent-Action-Patient** takes place after the syntactic structure is constructed.
- Once interpreted, it is hard to reverse the thematic assignment.
Experimental Evidence:

RCs with Topicalized Objects in Mandarin
The actress who has forsaken many boyfriends never felt regretful.

Chinese RCs with object topicalization

<table>
<thead>
<tr>
<th>RC</th>
<th>HEAD</th>
</tr>
</thead>
<tbody>
<tr>
<td>e 放棄過 好幾位 男友 的 女演員 從不後悔</td>
<td></td>
</tr>
</tbody>
</table>

forsake ASP many CL boyfriend DE actress always not regret
‘The actress who has forsaken many boyfriends never felt regretful.’
The actress who has forsaken many boyfriends never felt regretful.

"The actress who has forsaken many boyfriends never felt regretful."
The topicalized object is animate.

The actress who has forsaken many boyfriends never felt regretful.

‘The actress who has forsaken many boyfriends never felt regretful.’
The topicalized object is *inanimate*.

The actress who has given up many chances never felt regretful.

‘The actress who has given up many chances never felt regretful.’
Self-paced reading

- 2x2
  - topicalization of the object
    - \_V \text{N} \text{de} \text{N} V
    - \text{N} \_V t \text{de} \text{N} V
  - whether the topicalized object is animate
Experiment: Comprehension Results

Topicalization: (F1(1, 47) = 81.22, p < 0.000; F2(1, 23) = 41.79, p < 0.000)
Animacy: (F1(1, 47) = 18.94, p < 0.000; F2(1, 23) = 12.79, p < 0.002)
Interaction: (F1(1, 47) = 13.39, p < 0.001; F2(1, 23) = 8.06, p < 0.009)
Experiment: Reading Times

<table>
<thead>
<tr>
<th>Reading Time (ms)</th>
<th>V1/N1</th>
<th>CL/V1</th>
<th>N1/CL</th>
<th>DE</th>
<th>N2</th>
<th>V2</th>
</tr>
</thead>
<tbody>
<tr>
<td>animate-non-topicalized</td>
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</tbody>
</table>
Non-topicalized

Animate O > Inanimate O

N2 (t1(47) = 2.55, p < 0.014; t2(23) = 2.16, p < 0.041)
Topicalized

N2 (t1(47) = 3.11, p < 0.003; t2(23) = 2.50, p < 0.020)
Experiment: Comprehension Results
N2 (the head noun)
Discussion

- The comprehension accuracy showed that animacy was taken into consideration when Ss tried to answer the comprehension questions. (Sentences with inanimate topicalized objects were understood better.)
Discussion

- NVN sequences in Mandarin are also taken as Subject-Verb-Object.
- Semantic information (e.g. animacy) did not induce reanalysis at the NV regions.
- Syntactic analysis precedes semantic interpretation.
- Semantic information was not adequately suggestive of an alternative syntactic analysis.
Discussion

- Correct semantic interpretation was never arrived at.
- The results supported overall “good enough” and “shallow” processing in sentences with garden-path structures (Ferreira, 2003).
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