Is the Process of Syntactic Parsing Discrete or Interactive?

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Psychology of Language

Theoretical Context:

Discrete Model:

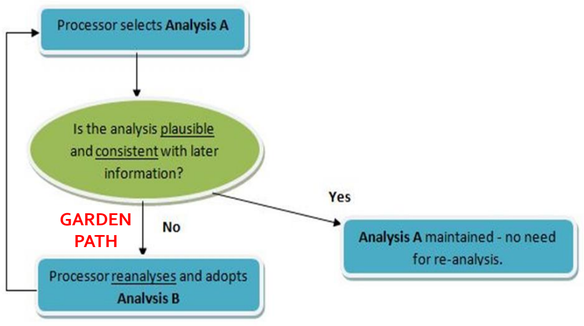
Principles (Frazier 1979/1987)

1. **Minimal Attachment**

Preference for the least amount of phrasal attachments in the syntactic tree.

2. **Late Closure**

Preference for keeping the clause open as long as possible.



Prediction:
These principles influence the initial parse.
If the first analysis is implausible, then reanalysis will occur, slowing down parsing.

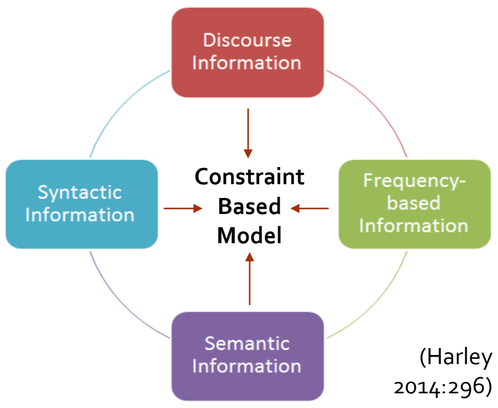
Evidence: Ferreira & Clifton (1986) measured reading times of ambiguity in reduced relative clauses:

→ Findings highlighted independence of syntactic processing and showed that information at later stages cannot prevent garden-path.

Interactive Model:

(MacDonald 1994) (Traxler & Tooley 2006)

Multiple sources of information interact and constrain listeners' interpretations.



(Harley 2014:296)

Prediction:
Multiple constraints influence the activation of alternative structures. If there is more than one possible interpretation, then competition will occur, slowing down parsing.

Evidence: Crain & Steedman (1985)

→ Semantically less plausible sentences were incorrectly judged ungrammatical far more often than structurally identical but semantically plausible sentences.

→ Suggests participants bring prior knowledge and expectations to experiments and context influences reading interpretations.

Unrestricted-Race Model:

Van Gompel et al (2001) found no clear evidence for purely discrete or interactive models.

Similarities with discrete models	Similarities with interactive models
- 2 stages - Reanalysis	- Uses all sources of information - Structures activated in parallel

Structures are engaged in a race, using different sources of information to influence activation, and if the most highly activated structure is implausible, reanalysis will occur.

Predictions:
- Globally ambiguous sentences will be processed **faster** – processor will never have to reanalyse as either construction will be plausible.
- Locally ambiguous sentences will be processed **slower** – processor will have to reanalyse if the initial parse turns out to be incorrect.

Evidence: Van Gompel et al (2001)
Used 3 related sentences which systematically differed in order to vary how the principle of **minimal attachment** and the constraint of **contextual plausibility** affected the comprehension of each sentence. Findings supported the unrestricted-race model.

Research Question and Hypotheses:

Research Question:

Does **late closure** or the constraint of **tense** play a more significant role in influencing comprehension of temporal clauses?

Hypotheses:

Hypothesis 1: Late closure plays a more significant role in influencing comprehension of temporal clauses.

Hypothesis 2: The constraint of tense plays a more significant role in influencing comprehension of temporal clauses.

Hypothesis 3: Neither late closure nor the constraint of tense influence comprehension of temporal clauses more than the other.

References:

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MacDonald, M.C. (1994) 'Probabilistic constraints and syntactic ambiguity resolution', *Language and Cognitive Processes*, 9, 157-201

Snedeker, J. & Trueswell, J.C. (2003) 'Using prosody to avoid ambiguity: Effect of speaker awareness and referential consents', *Journal of memory and language*, 48, 103-130

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Methodology:

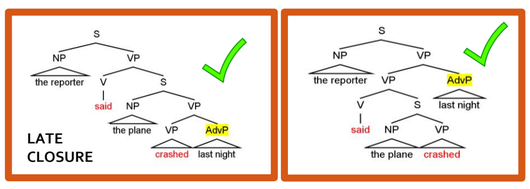
- Develop the methodology of Van Gompel et al (2001) and Crain & Steedman (1985).
- Aim: gain more conclusive evidence for discrete or interactive models.
- Investigate the principle of **late closure** and plausibility with regards to **tense**.
- Tense affects whether late closure interpretations are plausible or not.

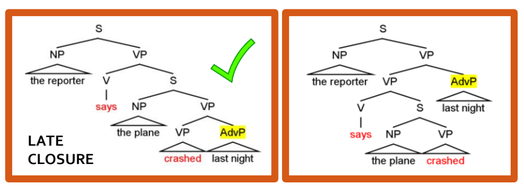
Participants: 36 Sheffield University students, native English speakers.

Procedure for each sentence:
- Each word will appear on screen for 300ms and remain on the screen until the sentence is complete, marked by *** (like Crain & Steedman 1985).
- Temporal inference question (e.g. 'what happened last night?') will be presented on the screen. This method will control factors such as speed and emphasis of question presentation.
- Participants will provide their answer verbally (instead of button pressing, as used by Crain & Steedman 1985), to reduce the risk of 50/50 guessing.

Stimuli:
10 sets of 3 sentences which vary systematically to alter how late closure and tense affect comprehension (similar design to Van Gompel et al 2001, but different variables).

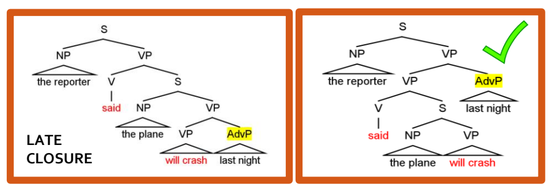
Condition A – ambiguous condition
The reporter said the plane crashed last night





Condition B – late closure condition
The reporter says the plane crashed last night

Condition C – early closure condition
The reporter said the plane will crash last night



Fillers:
- 81 fillers (like Van Gompel et al 2001: 236) - maintain temporal information but have different grammatical structures to the stimuli e.g. 'Matt went to the library yesterday'.
- Materials distributed in a random order, between 3 groups of 12 participants.

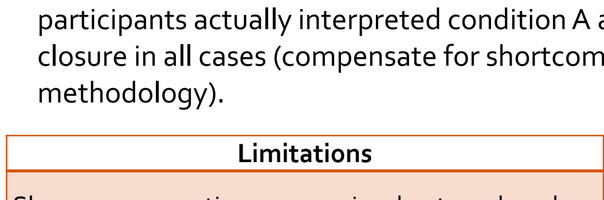
Data collection and analysis:
- Video and audio recording, with informed consent (see ethics application).
- Response time measured from the point at which the question disappears from the screen.
- **Main analysis**: collate average response times for conditions A, B & C to determine which condition was processed slower.
- **Supplementary analysis**: look at responses for ambiguous condition A to determine whether participants actually interpreted condition A as ambiguous or whether they conformed to late closure in all cases (compensate for shortcomings of Van Gompel et al's 2001 eye tracking methodology).

Limitations	Solution/justification
Slower response times may arise due to reduced focus over time.	Regular breaks will be provided with refreshments (see ethics application).
Responding verbally to questions presented on a computer screen may feel unnatural.	Practice questions will be provided to ensure procedure is familiar.
Unnatural due to intonation and punctuation being omitted which normally disambiguates sentences (Snedeker & Trueswell 2003; Hill & Murray 2000).	Artificial and controlled environments are required to investigate syntactic processing of ambiguous sentences.

Theoretical Predictions & Potential Outcomes:

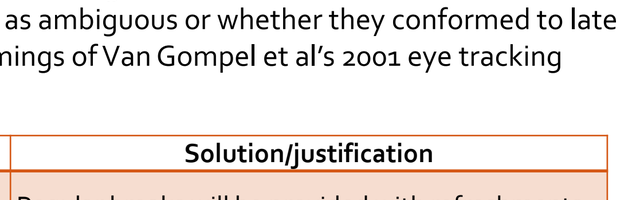
	Condition A (ambiguous)	Condition B (late closure)	Condition C (early closure)
Garden-path model	faster	faster	slower
Constraint-based model	slower	faster	faster
Unrestricted-race model	faster	slower	slower
Other?	?	?	?

Scenario 1



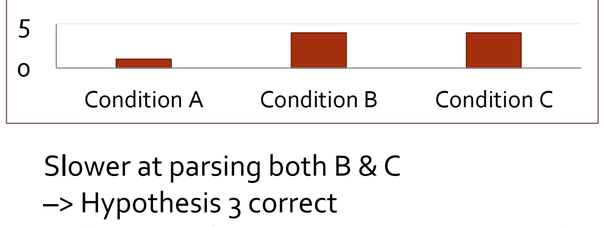
Slower at parsing only sentence C
–> Hypothesis 1 correct
–> **Evidence for garden-path model**

Scenario 2



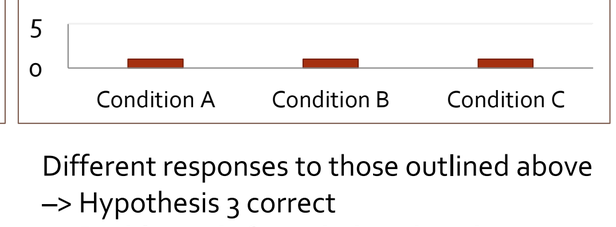
Slower at parsing only sentence A
–> Hypothesis 2 correct
–> **Evidence for constraint-based model**

Scenario 3



Slower at parsing both B & C
–> Hypothesis 3 correct
–> **Evidence for unrestricted-race model**

Scenario 4 (example)



Different responses to those outlined above
–> Hypothesis 3 correct
–> **Problematic for existing theories**