

VP-Internal Subjects and Incremental Processing

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Summary

We tested the VP-Internal Subject Hypothesis (VPISH) using a combined Self-Paced Reading/Lexical Decision Task paradigm. Results indicated that the moved subject may be re-accessed within the VP. Results are in principle compatible with VPISH. These findings will contribute more generally to our understanding of how long-distance dependencies are dealt with by the processor.

Background

VP-Internal Subject Hypothesis (VPISH): sentential subjects are generated within the verb phrase (VP) before moving to their sentence-initial surface position [1, 2]. **For example:**

(1) [TP [*The cyclist*]₁ ... [VP *t*₁ *ignored the warnings*]]

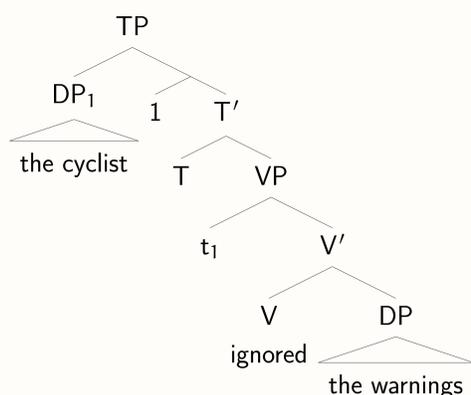


Figure 1: Underlying structure of sentence (1)

Motivating VPISH:

Q-Float: [*the cyclists*]₁ [*all t*₁ *saw the warnings*] [3]

Negation Scope: *all cyclists did not see the warnings* [4]

- NEG>QP: "not all cyclists saw the warnings"
- QP>NEG: "no cyclist saw the warnings"

Empirically powerful, well-accepted; **hardly investigated psycholinguistically** (though see [5]).

Hypothesis

Since trace is semantically bound by antecedent subject, antecedent subject should be re-accessed within VP layer during processing.

Therefore: Semantic priming effects near to the trace site but not elsewhere.

Methods

- Combined Self-Paced Reading and Lexical Decision Task.
- Fully-counterbalanced, repeated-measures design.
- Participants (n=28) read sentences (n=16) like (2), separated by fillers (n=32).

(2) *The cyclist knowingly and intentionally* [VP *t* *ignored the warnings*,] [TAG *suggests the Guardian*.]

Four conditions:

- 1 REL probe after VP verb vs.
- 2 REL probe after TAG verb vs.
- 3 UNREL probe after VP verb vs.
- 4 UNREL probe after TAG verb

NONCE probe (e.g., *PLANG*) always alongside target.

Semantic Relatedness measured using Latent Semantic Analysis (LSA):

- If $\text{cosine}(A,B) < \text{cosine}(A,C)$, A and B are semantically more related than A and C. See Table 1.

Subject	REL	Cosine	UNREL	Cosine
<i>cyclist</i>	PEDALLING	.62	BARREL	.17

Table 1: Target probes for *cyclist* and their LSA cosines

Participants' Task: decide whether they saw "any real English words."

Predictions:

- 1 Faster RTs in response to semantically related vs. unrelated probes following VP verb.
- 2 Faster RTs in response to semantically related probes following VP verb vs. following TAG verb.

Analysis & Results

GLMM for γ -distribution: $RT \sim \text{ProbeType} * \text{ProbePosition}$. See Figure 2.

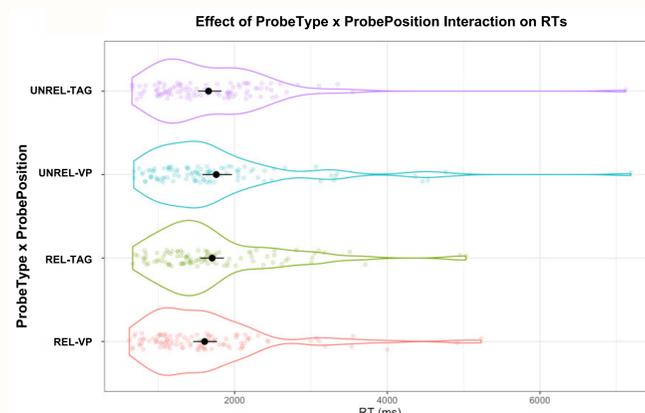


Figure 2: RT Distribution Across Conditions

Model Output: Significant $\text{ProbeType} * \text{ProbePosition}$ interaction ($p < .001$). No significant effect of ProbeType ($p = .13$) or ProbePosition ($p = .71$) in isolation. See Table 2.

	Estimate	Std. Error	t-value	p-value
(Intercept)	1857.69	35.59	52.20	<2e-16
ProbeType1	-47.11	31.10	-1.51	0.13
ProbePosition1	8.73	23/47	0.37	0.71
ProbeType1:ProbePosition1	-177.66	38.28	-4.64	0.0000035

Table 2: GLMER Model Output

Pairwise Comparisons (EMMs): RTs in REL-VP condition faster than in UNREL-VP condition (M: 1606ms; SD: 820 vs. M: 1759ms; SD: 1008, $p < .001$). RTs in REL-VP condition faster than in REL-TAG condition (M: 1606ms; SD: 820 vs. M: 1705ms; SD: 812) ($p < .036$).

Discussion & Conclusions

We concluded that the antecedent subject appears to be re-accessed within the VP layer during incremental processing of transitive English sentences, thereby giving rise to semantic priming effects in this location but not within the sentence tag.

Such effects are, in principle, compatible with VPISH, since a trace may re-activate a representation of the antecedent. They are, however, also compatible with a delayed processing account, where the subject may be held in working memory until it can be compositionally integrated.

Further work will test these two alternative explanations by (1) introducing a memory span task to introduce further intervening material/processing load between the overt subject and the hypothesised trace location and (2) investigating the way in which sentences with quantificational subjects are processed, since these may be re-accessed following the VP - a prediction that falls out of formal semantic models of quantification (e.g., [6]).

References

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