Intervention effects in wh-islands: an eye-tracking study

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INTERVENTION EFFECTS IN WH-ISLANDS: AN EYE-TRACKING STUDY
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BACKGROUND AND AIM OF THE STUDY

Long-distance dependencies are constrained both by syntactic and memory constraints.

- On the side of grammar, Relativized Minimality (RM) [1,2] states that the local relation between an extracted element and its trace is disrupted when it crosses an intervening element whose morphosyntactic featural specification fully matches that of the elements it separates.

(1)  What do you wonder who built ?
+Q +Q
FULL MATCH

(2)  Which building, do you wonder who built ?
+Q -N +Q
PARTIAL MATCH

(3)  What do you believe that the engineer built ?
+Q +N
ZERO MATCH

- On the side of the cognitive psychology of memory retrieval mechanisms, the cue-based Memory Model (MM) [3] states that long-distance dependencies require the retrieval of the extracted element at the verb. Retrieval is driven both by syntactic and semantic cues triggered by the verb which enable direct access to the relevant memory representation [4]. The probability of successfully retrieving the intended representation is determined by the feature match between the target (i.e. the extractor) and the probe (i.e. the verb), and by the feature distinctiveness between the target and irrelevant memory representations (i.e. the cue-based Memory Model).

Several acceptability studies conducted in English and French [5,6] showed that sentences with two lexically restricted wh-elements (4) are more acceptable than those with two bare wh-elements (1), even though in both cases the intervenor has the same featural specification as the extractor.

(4) Which building, do you wonder which engineer built ?

+Q -N +Q +N

This finding, difficult to account for by RM, is explained by MM as resulting of the greater semantic distinctiveness of lexically restricted wh-elements contributing to reduce retrieval interference. However, there is no direct evidence to date that the effect observed in offline acceptability judgments of wh-islands is indeed due to an easier retrieval of the extractor at the verb. If this explanation is correct, a reduced processing cost is expected at the verb (or the adjacent spillover region) when the extract is lexically restricted. The present study tests that prediction in an acceptability judgment study in Italian combined with an eye-tracking study.

METHOD

Participants: 37 Italian-speaking adults for the acceptability study; 36 Italian-speaking adults for the eye-tracking study.

Materials: 4 sets of 4 sentences each.

Variables manipulated: (1) Lexical restriction of the extracted wh-element Wh1 (Bare vs. Restricted).
(2) Lexical restriction of the intervening wh-element Wh2 (Bare vs. Restricted).

Wh1 Wh2 Sentences Conditions
Bare Bare a) What do you wonder who built ? Bare Identity
b) Who wonders which engineer built this building?
Bare Restricted c) Which building, do you wonder who built ? Inverse Inclusion
d) Which tourist wonders which engineer built this building?
Restricted Bare e) Which building do you wonder that engineer built ?
Restricted Restricted f) Which building do you wonder which engineer built ? Complex Identity

The experimental sentences with Extraction out of a wh-island were intermixed with 36 corresponding sentences with No Extraction for which no retrieval is needed at any moment and thus no interference is predicted to arise: (a) Who wonders who built this building?
(b) Who wonders which engineer built this building?
(c) Which tourist wonders who built this building?
(d) Which tourist wonders which engineer built this building?

TASKS: 1. Acceptability judgment on a 7-point Likert scale
2. Eye-tracking study

EYE-TRACKING MEASURES:
1. First fixation (FF), the duration of the first fixation in each region
2. Gaze duration (GD), the time spent on each region from the first fixation to the first time leaving it.
3. Second pass (SP), the time spent in a region entering it from the right
4. Total duration (TD), the total time spent on a given region
5. Regressions, a regression is a fixation if it occurred on a region on the left of the region were the n-1 fixation occurred. Each regression event was characterized on the origin of destination: 5a. Regressions Out, the region in which the n-1 fixation occurred
5b. Regressions In, the region in which the n fixation occurred

REGIONS OF INTEREST:
What/Which building do you wonder who/which engineer built in the Nineties?

WH1 V1 WH2 V2 SPILLOVER

RESULTS

ACCEPTABILITY JUDGMENT STUDY

EXTRACTION
Main effect of Wh1 (β= 0.38, t=4.30, p<.001)
Bare Identity = Inverse Inclusion = Complex Identity

NO EXTRACTION
Main effect of Wh1 (β= -0.16, t= -2.17, p=.05)
Main effect of Wh2 (β= -0.13, t= -2.56, p=.037)

Wh1 Wh2: (β = 0.09, t= -2.03 p=.04)
Bare Identity = Inverse Inclusion = Complex Identity

EYE-TRACKING STUDY

EXTRACTION

REGRESSIONS
Regressions in Wh1: more frequent when Wh1 is restricted than bare (β=0.70, z=4.789, p<.05)
Regressions in V1: more frequent when Wh1 is bare (β=0.48, z=3.698, p<.05)

ACCEPTABILITY JUDGMENT STUDY

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CONCLUSIONS

1. Structure with No Extraction were rated higher than structures with Extraction, replicating previous findings attesting to a detrimental effect of intervention [5,6].
2. Evidence for encoding vs. retrieval costs comes from the opposite effect that lexical restriction shows in Extraction and No Extraction conditions, which also reflects previous findings [6]. This result suggests that encoding cost (presumably at play in both the No Extraction and the Extraction condition) is associated with retrieval ease (presumably at play in the Extraction condition only) [5,6]. More direct evidence for encoding vs. retrieval costs comes from reading times in V2; when no retrieval is needed (i.e. No Extraction condition), the presence of additional syntactic and semantic features carried by lexical restriction makes the encoding harder, without rewarding this additional effort later in the process, leading to slower RTs in early measures (FF) on the contrary, when both encoding and retrieval are needed (i.e. Extraction condition), the presence of additional features easing the retrieval thus speeding up the process which results in faster RTs in V2 at both early and late measures (7).
3. However, results for the No Extraction condition also attested to faster RTs for restricted interveners, as Extraction conditions, for later measures following regressions (SP and TD). This may suggest that No Extraction conditions also contain an element of complexity causing regressions (possibly the presence of two wh-elements [8]), which would explain the inversion of the RTs pattern.
4. Regressions analyses for the Extraction conditions provide further evidence for retrieval: restricted Wh1 are associated with more regressions in V1, mostly coming from the spillover region, possibly pertaining to an attempt of retrieval; conversely, bare Wh1 are associated with more regressions in V1, possibly attesting to a difficulty in retrieving the extracted element when poor information is associated with it.

References: