Processing Evidence for QR: The Case of Antecedent Contained Ellipsis

1. Introduction: The problem of quantifiers in object position is a well-known case of syntax semantics mismatch. It arises when a quantifier, which cannot be analyzed as a referring expression, appears in an internal argument position, which is reserved for referring expressions. Various solutions to this problem have been proposed (e.g. type-shifting (Montague 1973,etc.), quantifier raising (QR) (May 1977, etc.), continuations (Barker 2001)), all of which maintain that semantic or syntactic composition is more complex for quantifiers in object than in subject position or for referring expressions in subject or object position. A recent self-paced reading study (Hackl et al. 2006) has shown that this difference in complexity affects real time processing. Specifically, it was shown that the quantificational vs. referring status of a DP affects local ambiguity resolution during first pass parsing. The current study extends this research to cases of antecedent contained ellipsis (ACE) and provides real time evidence for QR as being the mechanism to resolve the problem of quantifiers in object position.

2. ACE: ACE refers to ellipsis that is properly contained inside the expression that serves as the antecedent for ellipsis resolution (1). ACE is puzzling given that ellipsis resolution in general is subject to a parallelism constraint between antecedent and ellipsis site, which seems impossible to satisfy if the ellipsis is properly contained inside the antecedent. A straightforward solution to this paradox is to assume QR of the object DP, thereby undoing antecedent containment (2) (e.g. Sag 1976, etc.). This view is supported by a rich body of offline data such as the Williams-Sag generalization which fixes the scope of the object DP to be at least as high as the antecedent VP.

3. Real time processing of ACE: The goal of the present study is to determine whether this correlation is reflected in real time processing. Specifically, using the self paced reading paradigm, we compare definite and quantificational DPs in object position across three conditions definable in terms of the size of the gap, (3). In condition A there is no ellipsis at all (the gap is simply a trace) while conditions B and C contain "small" (= intermediate VP antecedent) and "large" (= root VP antecedent) ellipsis sites marked by "did" and "was" respectively. Since definite DPs need to undergo QR only in condition B and C but quantificational DPs undergo QR in all three cases, we expect to find an interaction in the region following the gap. Specifically, we not only predict that reading times (RTs) after the gap for definite DPs in condition B ("the-B") will longer than for "the-A." We also predict that RTs after the gap for "the-B" will be longer than RTs for "every-A" and "every-B" since in the latter cases QR is triggered already when the quantifier is encountered (5 words before the gap). RTs for "the-C" and "every-C," on the other hand, should both show an increase since QR into the root clause cannot be anticipated in either case before the size of the ellipsis is determined.

4. Results and Discussion: Figure (1) plots residual reading times for 48 subjects. Focusing on the second word after the gap we observe a highly significant interaction (Det.×Size: $F(2,46) = 4.363$; $p = 0.018$), which supports the above predictions. Specifically, we observe that RTs for "the-A" are lowest and that RTs for "the-B" are higher than RTs for "every-A" and "every-B." This is consistent with the hypothesis that "the-B" triggers QR at the ellipsis site while "every-A/B" trigger QR already when the quantifier is encountered. Support for this interpretation comes from a main effect of determiner over the two words following "the/every" (marked as DET in Figure 1) ($F(1,47)=4.86$; $p=0.032$). Furthermore, we observe an increase of RTs for both "the-C" and "every-C." The fact that the increase for "every-C" is larger than for "the-C," we argue, reflects reanalysis of (by default) local QR of the quantificational DP into non-local QR (QR into the root clause). No reanalysis of this sort is expected for definite DPs because the landing site of QR in these cases is determined at the same time QR is triggered.

DATA and Example Sentences

(1)   John talked to every student Mary did.

(2)   [[every student Mary <talked to t>]$_i$ [$_{VP}$ John talked to t$_i$]].

<div align="right">(Assuming reconstruction of the subject)</div>

Sample items:

(3) A. The doctor was reluctant to treat **the/every** patient that the recently hired nurse **admitted** after looking over the test results

   B. The doctor was reluctant to treat **the/every** patient that the recently hired nurse **did** after looking over the test results

   C. The doctor was reluctant to treat **the/every** patient that the recently hired nurse **was** after looking over the test results

Results: Figure 1: residual reading times for 48 native English speaking subjects.

	DET	book	that	the	exetremely	tenacious	teacher	Ved	before	going	home	for	summer	…	…
The/was	-33.196091	-45.194348	-29.363485	-40.582731	-55.746854	-34.7394	-18.150192	-1.4705702	-17.287032	68.9402321	16.2428415	-24.015721	-29.911296	-1.9676081	18.8103402
The/Did	-32.292148	-53.121235	-31.245215	-31.126084	-53.974049	-26.92507	1.62150766	1.66990604	-6.1630388	26.4585807	-17.272892	-28.41675	-30.99358	12.8228707	0.1843068
The/Verb	-27.933103	-47.363475	-32.469942	-33.160129	-51.083246	-27.433415	-8.9638968	0.06131557	31.9128973	-12.546144	-24.91714	-42.173501	-35.010657	4.53233273	11.1172892
Every/Was	-34.224365	-38.846871	-18.621042	-23.014667	-66.630036	-25.495273	-4.5947459	10.0127549	15.9870172	104.894996	37.5780261	-14.501511	-24.845349	63.718539	-0.9073932
Every/Did	-46.428557	-48.007279	-25.93527	-37.058103	-74.411519	-31.836877	-19.452559	5.74469109	5.91165498	2.11081761	-40.117803	-44.335212	-40.026964	-18.449003	-4.7120635
Every/Verb	-44.260824	-43.143769	-27.534195	-38.528821	-59.690174	-22.347551	-11.574367	21.5272916	6.0711174	7.87361316	-33.209667	-44.357666	-34.654909	11.3549796	9.07692339