Experimental Investigations of Antecedent-Contained Deletion

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1. Introduction to the Phenomenon

In a canonical instance of Verb Phrase Ellipsis (VPE) in English, as in (1), the site of ellipsis

(indicated by *did* in bold) marks the absence of a Verb Phrase. The ellipsis is interpreted by

'looking back' to a salient antecedent in the discourse (Hankamer & Sag, 1976; Sag, 1976) – in

this example, the VP *fell in love* in the first clause, as shown in (2).

(1)   Lady Sybil fell in love, and Lady Mary **did**, too.

(2)   Lady Sybil [$_{VP}$ fell in love], and Lady Mary **did** ⟨*fall in love*⟩, too.

        Antecedent-Contained Deletion (ACD) is a special case of VPE in which the site of

ellipsis is contained in its antecedent, as illustrated in (3) (Bouton, 1970).

(3)   Daisy eventually [$_{VP}$ knew how to prepare every dish that Mrs. Patmore **did**].

This situation gives rise to two well-known issues. First, as long as the site of VPE is contained

in its antecedent, the elided VP cannot be parallel, or identical, in form with the antecedent (Fox,

2002; Merchant 2000b). Second, if we assume that the ellipsis is to be resolved by copying in the

antecedent, then we face a second problem. Because the antecedent contains the VPE site,

whenever the antecedent is copied in, the VPE is as well, resulting in an infinite regress, as

shown in (4).

(4)   Daisy eventually [$_{VP}$ knew how to prepare every dish that Mrs. Patmore **did** [⟨*knew how*

        *to prepare every dish that Mrs. Patmore **did**⟩* [⟨*knew how to prepare every dish that Mrs.*

        *Patmore **did**⟩…*]]]

If we were stuck with this situation, the sentence would be uninterpretable, and our sentence

processors would be occupied indefinitely.

However, there is a solution, first proposed by May (1985), and fleshed out in subsequent years by Fiengo & May (1994), Fox (2000, 2002), Kennedy (1997), Merchant (2000a), among others. This solution relies upon Quantifier Raising (QR), a covert form of Ā movement in which a quantificational phrase is displaced in the structure at logical form, as illustrated in (5).[1] (For the time being, I will use notation suggesting that QR targets a landing site above the subject position, but I will revise this assumption shortly.)

(5)   a.   Base structure:

       Daisy eventually [$_{VP}$ knew how to prepare [$_{QNP}$ every dish that Mrs. Patmore **did**]].

       b.   QR of the QNP:

       [$_{QNP}$ every dish that Mrs. Patmore **did**]

       Daisy eventually [$_{VP}$ knew how to prepare [$_{QNP}$ *t*]]

       c.   Interpretation of the VPE via copying:

       [$_{QNP}$ every dish that Mrs. Patmore **did** ⟨*knew how to prepare*⟩]

       Daisy eventually [$_{VP}$ knew how to prepare *t*]

An alternative to (5) is to follow Fox (2002)'s proposal that there is covert rightward movement of the QNP followed by adjunct merger of the relative clause (Lebeaux 1988), thereby skirting a violation of parallelism. This step is followed by trace conversion and lambda extraction, as shown in (6). Either way, we can assume that the QNP is covertly displaced at LF in order to resolve the issues that ACD imposes on interpretation. Going forward, I will adopt the

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[1] This assumption is in contrast to an earlier proposal by Hornstein (1994) that A-movement was implicated. By now, it is standard to assume that this is not the case.

approach in (5).[2]

(6) a. Base structure:

   Daisy eventually [$_{VP}$ knew how to prepare [$_{QNP}$ every dish]].

  b. Rightward movement of the QNP:

   Daisy eventually [$_{VP}$ knew how to prepare [$_{QNP}$ every dish]] [$_{QNP}$ every dish]

  c. Adjunct merger of relative clause:

   Daisy eventually [$_{VP}$ knew how to prepare [$_{QNP}$ every dish]]

   [$_{QNP}$ ~~every dish~~ [$_{RC}$ *that Mrs. Patmore* **did** ⟨*knew how to prepare dish*⟩]]

  d. Trace conversion and lambda abstraction):

   every dish λx.*Mrs. Patmore* ⟨*knew how to prepare the dish x*⟩

     λy. Daisy eventually [$_{VP}$ *knew how to prepare dish y*]

  e. Interpretation of ellipsis:

   'For every dish that Mrs. Patmore knew how to prepare,

   Daisy eventually knew how to prepare those dishes'

   The movement operation that covertly displaces the QNP in ACD is semantically, and

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[2] There are, one might have guessed, non-movement-based approaches to ACD resolution, which do not rely upon variables and traces. I adopt an approach to ACD resolution here that relies upon covert movement, not only out of a personal proclivity, but also because such an approach is fairly standard approach in the field. It should be possible to translate the implications of the collective findings I review here into an alternative approach; however, where the distinction becomes most relevant is in the second part of section two, where we evaluate whether evidence from psycholinguistic studies with adults can be interpreted as directly indicating whether QR has taken place in ACD resolution.

not syntactically, motivated by needs related to compositionality and allow for interpretation. This movement targets a landing site that is higher in the structure. The landing site of QR indicates the site at which the QNP takes scope, and also has consequences for the binding principles, which are evaluated at LF.

Let us take binding relations first. While at first blush, it might look as though (7) would incur a Principle C violation (since the R-expression in bold is not free), the binding relation is evaluated once the QNP has QR'ed and is in a different position at LF, and so ACD bleeds Principle C.[3] However, the subsequent examples incur a violation for reasons related to the interpretation of ellipsis and the landing site. In (8), the pronoun from the surface is copied into the ellipsis site, resulting in a Principle B violation (Fiengo & May, 1994). Perhaps the most informative violations for QR, however, come from those in (9) and (10), since they reveal that the landing site that is targeted must be below the subject position. In both examples, a pronoun in subject position cannot be co-construed with an R-expression that it c-commands in the structure below it (Fox 1995, 2000; Johnson & Tomioka, 1998; Merchant, 2000a, b).

(7) a. Lady Rosamund$_k$ told **her$_i$** everything that **Lady Edith$_i$** thought she$_k$ would.

 b. Lady Rosamund$_k$ [$_{QNP}$ everything that **Lady Edith$_i$** thought [$_{CP}$ she$_k$ would ⟨*tell her$_i$*⟩]] told her

(8) a. *Lord Grantham mentioned **him$_i$** to everyone that **Tom Branson$_i$** did.

 b. *Lord Grantham [$_{QNP}$ everyone that [$_{CP}$ **Tom Branson$_i$** did ⟨*mention him$_i$ to*⟩]] mentioned **him$_i$** to

(9) a. ***He$_i$** told the Inspector everything that **Mr. Bates$_i$** thought he$_i$ should.

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[3] The fact that these binding relations are evaluated at LF, and not on the surface, has been observed by Fiengo & May (1994), among others.

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b. ***He**_i [_{QNP} everything that **Mr. Bates**_i thought [_{CP} he_i should ⟨*tell the Inspector*⟩]]

told the Inspector

(10) a. ***She**_i recounted every story **Cora**_i**'s housemaid** did.

b. ***She**_i [_{QNP} every story **Cora**_i**'s housemaid** did ⟨*recount*⟩] recounted

The scope-taking ability of the QNP based on QR is also illustrated in (11) and (12). In (11) there is a negative polarity item (NPI): *a damn thing*, modified with a relative clause with ACD. Because the NPI is only licensed as long as it falls under the scope of negation, a downward entailing environment (Fauconnier, 1975; Ladusaw, 1979, 1980), the QNP must QR to a positive below negation (Merchant, 2000a). Thus, there is further evidence that the landing site of QR is below the subject, and is adjoined to, e.g., *v*P. In (12), the sentence is ambiguous, because ACD is embedded within another VP. As a result, the QNP could QR out of the embedded VP, resulting in the embedded reading indicated below, our QR out of the matrix VP, resulting in either the matrix reading or the embedded reading indicated below. (Once the QNP is no longer contained in either VP, either one is a candidate for antecedent status.)

(11) Thomas won't do a damn thing Mr. Carson asks him to without an attitude.

Thomas won't [a damn thing Mr. Carson asks him to ⟨*do*⟩ without an attitude] do

(12) Isobel wants to know about every decision about the hospital that the Dowager does.

Embedded: … every decision about the hospital that the Dowager does ⟨*know about*⟩

Matrix: … every decision about the hospital that the Dowager does ⟨*want to know about*⟩

Now, in (12), ACD is embedded in a non-finite clause (*wants to know…*), and there is no question that the QNP should be able to move via successive cyclic movement to a position higher than both VPs. Until fairly recently there has been an assumption that QR is subject to a clause boundedness constraint, whereby a QNP cannot raise outside of a tensed clause, as shown

in (13).

(13)   A footman [VP said [CP that Mr. Carson inspected **every place setting**]].

a > every, every > a

If this is the case with QR in ACD, we would not be able to access the intended interpretation of (14), and would only be left with the embedded clause reading of (15). However, observations by Fox (2002) and Wilder (1995, 1997), and further theoretical proposals about successive cyclic movement of QR through the syntactic structure to allow such readings by Cecchetto (2004) have strongly suggested that this is not, in fact, the case, leaving room for experimental work to provide relevant informative evidence about constraints on QR, and therefore possible limits on available interpretations of ACD sentences.

(14)   Lady Cora expects that everyone will fancy Lady Rose that Lord Grantham does.

⟨*expect that those people will fancy Lady Rose*⟩

(15)   Spratt said he noticed every imperfection that Danker did.

Embedded: ⟨*noticed*⟩

Matrix: ⟨*said she noticed*⟩

This review has uncovered a host of characteristics and puzzles connected to the phenomenon of ACD. First, ACD is a form of VPE in which the site of ellipsis is contained in its antecedent. To resolve this situation, the QNP must undergo semantically-motivated QR to a position outside of the antecedent VP (most likely adjoined to *v*P). Second, this landing site is not only above the VP, but below the subject position, a fact that we can diagnose with binding relations and licensing of NPIs. Moreover, the landing site is not restricted to one location; ambiguous ACD sentences are such because there are multiple landing sites, correlated with different interpretations. Finally, there are cases where the accessibility of a landing site has been

questioned, based on a priori assumptions about QR, but ACD sentences have the potential to provide data bearing on such claims.

In the following two sections, I will summarize a growing number of experimental studies designed to tap into precisely these aspects of ACD. In the first section, we will evaluate what we know about children's interpretation of ACD sentences, and what the experimental results say about the mechanisms that are active in the child grammar. In the second section, we will evaluate evidence from studies investigating adults' interpretation of ACD sentences, which have direct bearing on linguistic theory. In the first case, evidence from ACD sentences provides us with a basis for questioning the apparent clause-boundedness of QR. In the second case, evidence from reaction times and acceptability ratings is taken to bear on theoretical assumptions regarding the nature of ACD resolution and our linguistic representations. The combined results across all tasks illustrate the reason why experimental research on ACD sentences provides us with a unique opportunity to investigate the composition of our grammar, and push the implications and limits of linguistic theory.

2. Investigations of ACD in Child Language Acquisition

One of the main goals researchers of language acquisition have is to determine the level of continuity in language acquisition and development. To that end, we seek to ascertain the interpretations that children assign to specific linguistic constructions as a means of crystallizing statements about the nature of their grammar, identifying the mechanisms they deploy for sentence interpretation, and determining the division of labor between what is learned, and what is not. For reasons outlined in the Introduction, ACD provides us with ideal testing grounds.

2.1. Evidence for QR in Child Grammar

Given that Quantifier Raising (QR) is a key component of the adult grammar (under the

theoretical framework being assumed here), one might ask whether children have QR as a part of their grammar. While a host of studies have examined children's ability to interpret quantificational sentences (e.g., Lidz & Musolino, 2002; Miller & Schmitt, 2004; Musolino & Lidz, 2006), many of these studies had not unambiguously demonstrated that children have a command of QR. For example, the ability to interpret a scopally ambiguous such as (16), which could mean either that every horse does not have the property of jumping over the fence or that it is not the case that every horse has this property, could arise from reconstruction of the QNP into the VP-internal base position. The ability to access the inverse scope reading of (17) might also arise via a choice function, rather than scope shifting (e.g., Reinhart, 1997; Winter, 1997).

(16)   Every horse didn't jump over the fence. $\forall > \neg, \neg > \forall$

(17)   The boy didn't blow out a candle. $\neg > \exists, \exists > \neg$

ACD, however, requires QR for resolution. So if children are able to successfully interpret sentences with ACD, this provides us with more reliable evidence that QR is part of the child grammar.

This was the starting point for Syrett & Lidz (2009)'s investigation of ACD in language acquisition. Four-year-olds and adult controls participated in a Truth Value Judgment Task (TVJT) (Crain & McKee, 1985; Crain & Thornton, 1998).[4] Because all of the acquisition experiments reported in this section – and some of the adult experiments reported in the next section – make use of these age groups and this methodology, I will take some space here to lay out the details of such a paradigm.

In a TVJT, there are typically two experimenters: one tells the child a series of short stories using toys and props or computer images, as a puppet (played by the second

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[4] See also Gordon (1998) for further details about this methodology.

experimenter) watches alongside. The child is told that the puppet is learning, and that the child's job is to watch and listen to the story carefully along with the puppet, so that s/he can help the puppet learn. At the end of each story, the puppet makes a statement about what s/he thinks happened in the story. This statement includes the target construction – in this case, a sentence with ACD. The child assesses whether the puppet's statement was accurate or not, given the context presented in the story. That is, the child must judge the truth value of the puppet's sentence, but instead of responding 'true'/'false', the participant responds by saying 'right'/'wrong' or 'yes'/'no'. If this puppet is right, he gets a special treat (e.g., a cupcake or cookie), and if he is wrong, he gets something lesser (e.g., milk or a banana); either way, he gets something. Participants are encouraged to provide a justification for the response, but with children this is not mandatory.

In Syrett & Lidz (2009), participants were randomly assigned to one of four experimental conditions, depending on the context and the linguistic construction they heard. The construction was either an ACD sentence or a sentence with coordinated conjunction. This contrast was chosen based on previous evidence that when children appear to misinterpret a relative clause construction (which ACD contains), they seem to default to conjunction (Tavakolian, 1981).[5] There were multiple trials for each condition, as there were in all TVJT

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[5] Early conclusions based on these misinterpretations as exhibited in act-out tasks were that children could not represent the relative clause in their grammar (Tavakolian, 1981). However, this conclusion based on performance data was unwarranted, since satisfaction of the felicity conditions of the use of a relative clause yields correct interpretation (Hamburger & Crain, 1982), and children have no difficulty comprehending relative clauses, as control items from the TVJT experiments reported here indicate.

experiments reviewed here.

(18)   Miss Red jumped over every frog that Miss Black did.   (ACD)

(19)   Miss Red jumped over every frog, and Miss Black did, too. (Coordinated Conjunction)

Each of these sentence types was presented in one of two contexts. In one, there was one set of objects (e.g., frogs that two characters had to jump over), and in another, there were two sets (e.g., two sets of frogs, one for each character to jump over). In the one-set condition, each character attempts to jump over all of the frogs in succession. However, in the end, neither one does so, and consequently, neither wins a prize. In the second condition, each character jumps over all of her frogs (but none of the other character's frogs), and each therefore receives a prize.

In the one-set condition, the ACD sentence is true, and the conjunction sentence false, while in the two-set condition, the ACD sentence is false, and the conjunction sentence true. Accordingly, both child and adult participants consistently accepted the ACD sentence in the one-set condition, and rejected the conjunction sentences, and demonstrated the reverse pattern in the two-set condition. The only mild surprise was that some adult controls were not as willing as the children were to restrict the domain of quantification in the two-set condition, and rejected the sentence, because the characters had not jumped over *every* frog.

The results of this experiment thus demonstrate that four-year-old children, like adults, correctly interpret ACD sentences, and therefore that they must have the QR mechanism in their grammar. Presented with evidence that children can perform QR and interpret ACD sentences, one might further probe just how adult-like their QR and ACD resolution are. That is, do they target the same landing sites as adults? The next two experiments reported in this section were designed to address precisely this question.

2.2. Evidence for the Landing Site of QR in Child Grammar

Above, we observed that the landing site of QR in ACD sentences must be below the subject position. As a result, it lands below negation and can therefore allows for NPIs in the construction to be licensed, bleeds Principle C violations with a pronoun in the object position and an R-expression in the relative clause, but feeds Principle C violations with a pronoun in subject position and an R-expression in the relative clause. Kiguchi & Thornton (2004) took these observations from Fox and Merchant, and sought to determine how children's interpreted ACD sentences in which binding principles were invoked. Their test sentences across a set of experiments had structures as indicated in (20)-(22).

(20) a. Dora gave **him$_j$** the same color paint **the Smurf$_j$'s** father did.

  b. Dora [the same color paint the **Smurf$_j$**'s father did <give **him$_j$**>]

    [$_{VP}$ gave **him$_j$** *t*]

(21) a. *The Mermaid baked **him$_i$** the same food that **Cookie Monster$_i$** did.

  b. *The Mermaid [the same food that **Cookie Monster$_i$** did <bake **him$_i$**>]

    [$_{VP}$ baked **him$_i$** *t*]

(22) a. ***He$_i$** jumped over every fence that **Kermit$_i$** tried to.

  b. ***He$_i$** [every fence that **Kermit$_i$** tried to <jump over>]

    [$_{VP}$ jumped over *t*]

In each of the scenarios, the experimenters manipulated the story so that there were two possible antecedents for the pronoun: the character denoted by the target R-expression in the sentence and another salient character of the same gender (e.g., Mickey Mouse in (20), Jabba the Hutt in (21), or Cookie Monster in (22). Moreover, when the puppet delivered the target sentence, he mentioned the key players in the scenario, with the possible coreferent from the sentence listed last. In the ungrammatical sentences, this order of mention was intended to

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highlight this possibility of this character being co-construed with the pronoun.

Children responded corrected to control ACD sentences without pronominal reference (e.g., *Kermit found Emily the same color egg that Gonzo did*) at a rate comparable to that of adults: close to 100% of the time. Children accepted sentences like (20), but rejected those like (21) (which has a Principle B violation) and (22) (which incurs a Principle C violation). (22) is the key sentence for demonstrating that the landing site for QR is below the subject, while all three sentence types demonstrate something about how children perform QR and interpret elided material.[6]

2.3. Evidence for Multiple Landing Sites for QR in Child Grammar

Having established that children can correctly interpret ACD sentences, and further that they appear to target the same landing site as adults, we can probe their grammar further and determine whether children have the same range of accessible landing sites as adults do, or whether they are restricted to e.g., the closest landing site (arrived at via shortest move). In Syrett & Lidz (2005, 2011), the goal was to present child and adult participants with ambiguous ACD sentences, where the ambiguity stemmed from the ACD being embedded within multiple VPs. In one set of experiments, ACD was embedded in a non-finite clause, with matrix verbs that selected for an infinitival complement (*want, need, ask, invite*), including possible restructuring and non-restructuring verbs.[7] An example is shown in (23).

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[6] But see discussion in Syrett & Lidz (2009) concerning how a conjunction interpretation and pragmatic reasoning could yield a similar pattern. Thus, the combination of Syrett & Lidz (2009) and Kiguchi & Thornton (2004) provides evidence that children correctly interpret ACD sentences, and therefore that QR is part of child grammar.

[7] See discussion in Kennedy (1997) related to claims by Hornstein (1994).

(23)   The cowgirl needed to jump over every frog that the old cowboy did.

Embedded: … every frog that the old cowboy ⟨*jump over*⟩

Matrix: … every frog that the old cowboy ⟨*need to jump over* ⟩

In a second series of experiments, the matrix verb took a tensed clause as a complement, resulting in ACD being embedded in a finite clause, as in (24). There is thus a crucial difference between the two cases in terms of a possible tensed clause boundary present in the latter case. This point will become relevant shortly, and will be taken up again in the next section in a series of studies conducted exclusively with adults.

(24)   Clifford said that Goofy read every book that Scooby did.

Embedded: … every book that Scooby ⟨*read*⟩

Matrix: … every book that Scooby ⟨*said that Goofy read*⟩

In each case, the target sentence was presented in one of two between-subject conditions: one that made the embedded reading true and the matrix reading false, and one that made the embedded reading false and the matrix reading true. The crucial question in both cases was whether children could access the matrix reading, since this would then indicate that they can perform so-called "long QR" and are not restricted to the first possible landing site and can QR to a position outside of the matrix VP (Kennedy, 1997; Larson & May, 1990).

When children were presented with sentences like (23), where ACD is embedded in a non-finite clause, in either the 'embedded' or 'matrix' context, they – like adults –were able to access either of the two readings. Furthermore, participants either accepted the target sentence, justifying their response with the reading made true in the context, or rejected it, appealing to the reading that was made false. Thus, children are able to perform both "short" and "long" QR. This conclusion was further bolstered by a follow-up study conducted by Sugawara et al. (2013), in

which a verb and tense mismatch between the matrix and embedded clause disambiguated the readings.

When all participants were presented with sentences like the one in (24), the adults and the children showed a very different pattern. Adults, for the most part, patterned as one would expect, if QR were subject to a clause boundedness constraint: they accepted the sentence in the context that made the embedded reading true (and the matrix reading false), and rejected it in the context that made the matrix reading true (and the embedded false). By contrast, children were prone to rejecting the target sentence, flying in the face of expectations and the principle of charity. This pattern is not only curious, because it seemed as though children are being contrary, but because if children really are overgenerating interpretations of these ACD sentences, and are too lenient with the QR operation, it seems nearly impossible to arrive at a learnability story whereby they might encounter evidence that would allow them to prune away the grammatically barred readings of these ACD sentences, which are rarely-encountered in adult speech, let alone child-directed speech.[8] Thus, we are faced with a classic Poverty of the Stimulus argument.

However, a closer look at the adult responses revealed that a small subset of adults were patterning in the same way, consistently accessing the matrix reading of sentences in which ACD was embedded in a finite clause. Thus, for these adults, it would appear that QR was not subject to a clause-boundedness constraint. Thus there would be no learnability story to tell: children and these adults have in common that QR is not subject to clause boundedness. If this is the case,

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[8] One need not rely on this precise kind of ACD construction, of course, to learn the limits of application, but then it is extremely challenging to identify an analogue with another linguistic construction that would allow the learner to arrive at the adult state. (See related discussion across Pullum & Schulz (2002) and Legate and Yang (2002).)

then two questions arise: (a) what licenses the matrix reading of these ACD sentences (i.e., what allows QR to target a matrix-VP external site), and (b) what was preventing the vast majority of adults from accessing the matrix reading in such sentences? These questions are pursued in the next section.

3. Investigations of ACD in Adult Grammar

3.1. ACD as Evidence against Clause-Boundedness of Quantifier Raising

If QR is a covert form of Ā movement, on a par with *wh*-movement, it seems unexpected that QR should be subject to a clause-boundedness constraint, whereas *wh*-movement is not. A simple comparison between the two cases (as in (25)-(26)) highlights this difference. In (25), the *wh*- phrase can undergo successive cyclic movement out of the object argument position of a verb in a finite embedded clause to land in a position above the subject, whereas in (26), the universally-quantified phrase in object position seems to be unable to take wide scope over the indefinite in subject position.

(25)   **What** did a footman [$_{VP}$ say [$_{CP}$ that Mr. Carson inspected *t*]]?

(26)   A footman [$_{VP}$ said [$_{CP}$ that Mr. Carson inspected **every place**]].   *a > every, *every > a*

However, enough counterexamples have been presented over the years, among them those in (27) and (28), to lead to the conclusion that this is not a hard and fast constraint. (See also Farkas & Giannakidou (1996).)

(27)   A quick test confirmed [$_{CP}$ that each drug was psychoactive].   VanLehn (1978)

(28)   A doctor will make sure [$_{CP}$ that we give every new patient a tranquilizer].Reinhart (1997)

Perhaps more to the point here, the matrix reading of sentences in which QR must occur out of a finite clause appears not only to be accessible, but sometimes forced, as in (29) (a comparative construction in which the degree phrase undergoes QR) and (30)-(31), ACD sentences.

(29)   John thinks that Mary is taller than Bill does.   Wilder (1997)

⟨*think that Mary is d-tall*⟩

(30)   I expect (that) everyone will visit Mary that you do.   Tiedeman (1995), Fox (2002)

⟨*expect those people to visit Mary*⟩

(31)   John said that you were on every committee that Bill did.   Wilder (1997)

⟨*say that you were on those committees*⟩

Faced with these suggestive examples paired with the data from children and adults in Syrett & Lidz (2011), Syrett (2015a) undertook a series of studies with adult participants in order to probe the availability of the matrix reading of sentences in which ACD is embedded in a finite clause, as in (32).

(32)   Woody$_i$ said he$_i$ jumped over every frog that Jessie did.

To facilitate the availability of this reading, the experimental contexts were manipulated to support the discourse conditions that would make the matrix reading felicitous. First, the event denoted by the embedded verb (e.g., jumping) was never shown. Second, the act of reporting was made especially salient, since both characters mentioned in the sentence reported their actions to a third party, and these speech events were accompanied by a speech bubble above the animated images on a computer screen. Next, instead of saying, "I know what happened!" at the end of each story, the puppet exclaimed, "I know that X said!"

In addition to manipulation of the context, the target linguistic sentence was also manipulated to facilitate processing. First, the embedded CP did not have a *that* complementizer. (However, a follow-up experiment demonstrated that even with the complementizer present, the matrix reading was robustly available.) Second, the embedded subject was a pronoun in lieu of a full name. Next, contrastive focus was placed on the two main characters (see Wilder (1995) for

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a related observation). Finally, the ACD constructions were extended beyond just the universal quantifier to those with *the same*, as in (33).

(33)   Jake$_i$ said (that) he$_i$ found the same treasure as Captain Hook did.

The response pattern obtained across experiments, accompanied by full-fledged justifications, leaves no doubt that the matrix reading is indeed available to adults, and therefore that QR can cross a tensed boundary. The percentage of matrix readings ranged from 37% to 48% at the lowest, and 94 to 95% at the highest. Thus, speakers allow not only "long QR" out of non-finite clauses, but also finite clauses as well, and do so robustly when the discourse conditions support the matrix reading.

This ability to access the matrix reading of ACD embedded in a finite clause is actually predicted under Cecchetto (2004)'s proposal, in which QR proceeds in a successive cyclic fashion, motivated by Scope Economy and constrained by the Phase Impenetrability Condition (Chomsky 1999/2001), whereby each sub-link of the movement is semantically motivated and crosses just one instance of *v* or C (each a phase). In fact, under Cecchetto's account, once the QNP lands outside the matrix VP, it could raise even higher, again as long as the QR is semantically motivated and respects movement constraints. The prediction is that if there is an indefinite in subject position that could interact scopally with the QNP, and generate a distinct semantic interpretation then this would license movement. This prediction is borne out.

Syrett (2015b) followed a methodology similar to the previous TVJTs, and similar to Syrett (2015a) in particular. Participants were presented with sentences such as (34) in a context that supported an "extra wide scope" reading of the QNP over the subject indefinite and a matrix reading of the VPE.

(34)   Someone$_i$ said he$_i$ could jump over every frog that Jessie did.

In the story corresponding to this target sentence, Jessie claims to Woody she can jump over a set of frogs. Following her departure from the scene, a group of young boys, who have overheard her boasts, enters. Each one approaches one of the frogs and makes a claim that he can jump over that frog. When Jessie returns, Woody reports back to Jessie what the boys have said. Irate, she storms off. The puppet then recaps, "I know why Jessie was so mad! *Someone said he could jump over every frog that Jessie did*." Adult participants accepted the sentence over 40% of the time, with close to 39% of the written justifications provided unambiguously pointing towards the extra wide scope reading.

3.2. ACD and Possible Evidence for Theoretical Frameworks

There is robust evidence that both young children and adults are able to provide offline judgments indicating their interpretation of ACD sentences, and the role of the grammar, the discourse, and the processor in licensing various interpretations. We might, then, ask whether online data – that is, data that are collected from real-time sentence processing studies – can provide us with further insight into the nature of the representations of ACD sentences. This was the goal undertaken by Hackl et al. (2012).

Hackl et al. (2012) presented participants with sentences as in (35)-(36) in a self-paced reading study. The factors that were manipulated included the head of the object phrase containing the relative clause (*the/every*), the presence of a lexical verb or a site of ellipsis (e.g., *funded* v. *was*), and (in Experiment 2), whether the intended antecedent for ellipsis was a small or large VP (e.g., *did = treat…* or *was reluctant to treat…*) The authors predicted that since the universal quantifier would have to undergo QR for reasons of type mismatch anyway, the semantically-motivated movement would facilitate processing in the case of ACD relative to the definite determiner, but that this facilitation would only have an advantage in the case of the

embedded VP (which would implicate short QR) and not with the matrix VP (which would require long QR, and involves a more complex VP to process).

(35)   The understaffed general hospital was negotiating with {**the/every**} doctor that the nonprofit medical organization {**funded/was**} in order to arrange for free vaccination clinics.

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

The results for Experiment 1 demonstrated an initial slow-down for the sentences with a lexical verb in the 'spillover region' immediately following the main verb or auxiliary in the matrix sentence, followed by a crossover with a slow-down for the ellipsis cases. In both experiments, the 'determiner' *the* sentences incurred increasingly longer time than the quantificational *every* sentences, and the results yielded a determiner-ellipsis interaction in Experiment 1 and a determiner-ellipsis size interaction in Experiment 2 (with *the-was* sentences taking longer). Hackl et al. (2012) thus concluded that the presence of the universal quantifier facilitates resolution of ACD downstream, and that this finding supports a QR approach to ACD resolution.

However, the interpretation of these findings was subsequently challenged by Szabolsci (2014), who has pointed out that under a variable-free approach, the slow-down with *the* can be accounted for, because a default 'individual-forming' interpretation of the definite determiner will not work for the interpretation of the sentence. The reinterpretation will trigger a reprocessing of the preceding material, and result in a slow-down of reading time. Moreover, if the default processing interpretation for the antecedent of ellipsis is a small VP antecedent, then this preference may account for he RTs observed in Hackl et al's Experiment 2.

Gibson et al. (2015) have also taken issue with the interpretation of Hackl et al's conclusion that the results support a QR theory of ACD resolution, arguing that the target sentences tipped the scales in favor of a slow-down with *the*, since in such cases, a speaker would normally provide an additional expression highlighting sameness, such as *same* or *also*, and that the most natural production in the target sentences would be one where the two lexical verbs. In their experiments, they manipulated the type of determiner (*every* v. *the*), the presence or absence of the words *same* and *also*, and the presence or absence of a full VP and whether or not it was different (e.g., *negotiate*, *funded*), as illustrated in an abbreviated form in (37). The also excluded the spillover region, since they were obtaining acceptability ratings.

(37)   a.   The understaffed general hospital was negotiating with {**every/the (same)**} doctor that the non-profit medical organization {**(also) was/ funded/was negotiating with**}.

        b.   The choreographer evaluated {**every/the (same)**} ballerina that the lead dancer {**did/evaluated**}.

Across tasks, they replicated the determiner-ellipsis interaction, but further demonstrated a significant effect of verb type (with the different verb increasing acceptability at a comparable rate for both *every* and *the*) and an enhancing effect of *same* and *also* neutralizes the effects in that it increases acceptability of *the* sentences but reduces acceptability of *every* sentences. Thus, the authors concluded that the original processing data do not unambiguously signal a QR analysis of ACD sentences, and that the effects could arise via other means. Clearly, this lively exchange regarding the processing and acceptability judgments of ACD sentences highlights the reasons why research on ACD is a hotbed of research, and how the results arising from experimental work in this area may directly bear upon theoretical proposals in the field of

linguistics about the nature of our linguistic representations.

4. Conclusions and Future Directions for Research on ACD

The experimental evidence collected over a range of experiments demonstrates the following. First, children as young as four years of age can arrive at the correct interpretation of ACD sentences, thereby indicating that the QR mechanism is part of the child grammar. Second, when children perform QR to resolve ACD sentences, they target a landing site that is outside of the antecedent VP but also below the subject, and are not restricted to the nearest landing site. Given an ACD sentence made ambiguous by ACD being embedded in multiple VPs, children and adults are able to access both candidate interpretations. This finding holds not only for ACD embedded in non-finite clauses, but also for ACD embedded in finite clauses–but in the latter case is dependent upon discourse and processing factors being controlled for successfully. Finally, online processing and offline acceptability tasks with ACD sentences allow us to obtain evidence that bears potentially not only on how we represent and resolve such configurations, but also on the theoretical framework we adopt. Future research on ACD should further probe the limits of ACD configurations and interpretations, investigate the interaction of *wh-* words and ellipsis in ACD sentences, examine the role of binding principles in ACD configurations, and determine at a more fine-grained level what our real-time processing of ACD sentences says about the nature of our grammar and the role of extragrammatical factors.

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