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RESEARCH

Long-distance extraction attraction: A production-based account of an unexpected cross-linguistic structure

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The focus of this paper is a grammatically unexpected long-distance (LD) extraction structure in which the extracted element morphologically articulates with the verb of the clause where it is pronounced rather than with the verb of the extraction clause. The structure manifests itself differently cross-linguistically, depending on the language's morphosyntax. I suggest that this grammatical possibility evolved in response to the sentence planning challenge posed by LD wh-movement. Specifically, LD movement structures conflict with the incremental clause-by-clause planning production process; the fronted element relates to a clause whose internal structure isn't planned at the outset. The unexpected structure is seen as a consequence of production pressures playing a role in shaping grammars.

Keywords: language production; performance-grammar correspondence hypothesis; long-distance wh-movement; extraction attraction; wh-agreement; externalization

1 Introduction

One approach to an account of language variation is to explore the potential role of the processing systems in shaping grammars (e.g., Hawkins 1994; 2004; MacDonald 2013; Hawkins 2014; McDaniel et al. 2015). Hawkins's fundamental observation is that processing difficulties in some languages correspond to ungrammaticality in other languages (Performance-Grammar Correspondence Hypothesis, Hawkins 2014: 3). This phenomenon suggests that grammars are in part determined by processing pressures. Hawkins's work shows that many cross-linguistic patterns can be accounted for in these terms. Similarly, MacDonald (2013) proposes the Production-Distribution-Comprehension account, which holds that sentence planning pressures affect language form. The perspective taken here is that human grammars are constrained by Universal Grammar, possibly with Merge at its core (e.g., Hauser et al. 2002). But Merge alone is not enough to fully account for the evolution of language and the possible grammars that emerge. The processing systems come into play as fundamental factors in the process of externalization (Chomsky 2010). Hawkins focuses primarily on the contribution of parsing pressures in shaping grammars, whereas MacDonald and colleagues argue that production pressures are primary and that parsing principles secondarily reflect sentence-formulation processes (e.g., Gennari & MacDonald 2009; MacDonald & Thornton 2009; MacDonald 2013). Similarly, McDaniel et al. (2015) argue that the production system plays at least as important a role as comprehension. In many cases parsing and production pressures drive grammars in the same direction. For example, a fronted topic aids the parsing process by signaling the topic at the outset, and also allows the speaker to begin with the most salient part of the message.

But production and comprehension pressures can also be in conflict. For example, overt morphological case marking seems to benefit the parser rather than the speaker. Wasow (2002) argues that heavy NP shift is better accounted for in terms of production than parsing, proposing that the Principle of End Weight (Quirk et al. 1972: 14.8) derives from a sentence-planning preference rather than a parsing preference. McDaniel et al. make the same claim about the *that*-trace effect; the *that*-trace structure would create a challenge for the production system (since a new planning unit begins with an empty category), whereas it would facilitate the gap-finding process for the parser (since the sequence *that* + VP would clearly signal the gap).

The focus of the current research is a cross-linguistic phenomenon in long-distance (LD) extraction structures that is arguably best accounted for in terms of a response to a production pressure. The structure involves a type of grammatical attraction effect where a constituent extracted from an embedded complement clause is integrated with the upper clause verb, as though it had originated in the upper clause. Crucially, these structures are grammatical rather than the result of speech errors. The extraction attraction phenomenon (henceforth, EA) manifests itself differently in different languages, depending on language-specific morphology, as discussed below. The accounts of these structures in the syntactic literature vary depending on the specifics and do not treat EA as a uniform phenomenon (though both Boeckx 2008 and den Dikken 2009 include many of the structures in discussions of successive cyclicity). This lack of uniformity is not incompatible with the account proposed here. The general idea is that the syntactic system allows for certain possibilities, and processing pressures push languages in certain directions. Differences in the languages (such as in their morphology and word order) will lead to different solutions to the same processing challenge. In order to explore EA cross-linguistically, a descriptive approach is taken that abstracts away from in-depth syntactic analyses. This account is therefore compatible with varying analyses. It can be seen as aiming for the level of broad explanatory adequacy – why languages would have these unexpected structures.

This paper is organized in the following way. Section 2 is a discussion of the processing challenges posed by LD extraction structures, with focus on the sentence planning process. Section 3 characterizes the EA structure and its manifestation in a variety of languages. Section 4 considers non-EA LD extraction structures that are compatible with this account. Section 5 is a discussion of the broader significance of EA, in particular with respect to the role of language production in shaping grammars. Section 6 is a brief summary and conclusion.

2 The processing challenge

Research on language production has yielded models that include a number of levels, from conceptualization to articulation (e.g., Garrett 1980; Levelt 1989). Broadly, speaking involves generating a preverbal message, retrieving lemmas (lexical items without their phonological form), encoding a morpho-syntactic structure (including features corresponding to functional elements), encoding the phonology (retrieving the phonological forms of the lexical items and then the phonological forms corresponding to the grammatical features), and articulating a phonetic plan (determining the phonetic forms and the prosody). The parsing process would run similarly but starting from the output and working back to the message.

Within this general framework, sentence planning proceeds incrementally, and the size of the planning window varies (Ferreira & Slevc 2007; Konopka 2012). The finding most relevant to the EA structure is that the clause is a major planning unit (Boomer 1965; Ford & Holmes 1978; Beatie 1980; Butterworth 1980; Bock 1996; Clark & Wasow 1998; McDaniel et al. 2010; 2015). So, for example, in the production of a two-clause sentence, planning

would initially focus on the material up to the clause boundary (probably including the top node of the embedded clause), and planning for the inside of the embedded clause would follow.

Extraction structures, even in short-distance (SD) extraction, pose some challenges for the processing systems, since the word order change requires procedures that are different from the ones used in non-extraction. Consider the sentence *Who did you see?*, for example. Having the wh-phrase fronted may facilitate the parsing process by signaling that it's a question, as well as the planning process by allowing the speaker to start with the focused element (which is likely at the forefront of their mind). But it also creates the parsing challenge of the search for the gap, and the production challenge of planning a clause with non-canonical word order. In fact, speech errors have been reported that show attraction effects in SD wh-structures, where the verb inflection indicates number agreement with the fronted wh-phrase rather than with the subject, as in *Which flowers **are** the gardener planting?* (Kimball & Aissen 1971; Dillon et al. 2017).

If the clause is a major processing unit, then it's expected that LD extraction would pose an additional challenge. For the parser, the challenge is carrying the search for the gap into a new clause (Frazier & Clifton 1989). For the speaker, the challenge is planning the filler and gap structures at different points. Consider, for example, the sentence *Who do you think that Jo saw?* The speaker would first plan *[Who do you think [CP]]* and then plan the internal structure of the CP. The challenge is that *who* is structurally linked to the inside of the CP that isn't planned till later.

Various ways the equivalent of LD wh-structures are handled cross-linguistically in languages that have SD wh-movement could be seen as responses to the processing challenge. Some examples are listed in (1).

(1)
a. LD wh-movement is disallowed (e.g., Armenian, Anyadi & Tamrazian 1993; Gbadi, Koopman 1984).
b. LD wh-movement is only allowed out of untensed clauses (e.g., Russian relative clauses, Comrie 1973).
c. LD wh-movement is only allowed out of a lower clause that is reduced (e.g., one LD wh-structure in Selayarese drops the otherwise obligatory complementizer, Finer 1997).
d. LD wh-movement is only allowed with a limited set of bridge verbs (cross-linguistic, e.g., Erteschik-Shir 1973).
e. LD wh-movement works best with obliques, then objects, and worst with subjects –the Keenan-Comrie Hierarchy in reverse (Keenan & Comrie 1977; e.g., Hungarian, Marácz 1988; German, Kiziak 2010).
f. LD wh-movement is allowed in interrogatives but not in relative clauses (e.g., extraction out of tensed clauses in German, Kvam 1983).
g. The equivalent of LD wh-movement involves a parenthetical-type structure (e.g., German, Kiziak 2010).
h. The equivalent of LD wh-movement pied-pipes the whole embedded clause (e.g., Basque, de Urbina 1990).
i. The equivalent of LD wh-movement is a partial wh-movement or wh-copying structure (e.g., German, Fanselow 2006; Höhle 2000; Shona, Zentz 2016).
j. LD wh-movement is an extraction attraction (EA) structure.

Several of these, or a combination, often occur in the same language. For example, the *that*-trace effect is a combination of (1c) and (1e).

Taken together, these structures provide support for a role of processing in shaping grammars. This paper focuses on EA, which is arguably the clearest evidence in support of an account specifically based on the role of the production system, since for the parser, EA appears to be at best unhelpful and at worst misleading.

3 The extraction attraction (EA) structure

The EA structure is an LD extraction structure where the extracted element integrates morphologically with the higher clause verb instead of with the verb of the clause it extracted from, behaving like an argument of the higher verb. The specifics depend on the language's morphosyntax. Generally, the consequence is that an LD extraction sentence beginning like *Who do you think* ends up morphologically parallel to an SD extraction sentence like *Who do you admire?* I treat the EA structure as a kind of attraction effect, since the morphology suggests a local relationship that appears to be inconsistent with the syntax. However, the attraction effects reported in the production literature are speech errors, usually involving number agreement (e.g., Bock & Miller 1991), whereas the EA structure is grammatical.

In addition to the EA structure being unexpected with respect to the grammar, it also seems problematic for the parser. Instead of aiding the gap-finding process, the morphosyntax signals falsely that the gap is in the higher clause. But the EA structure is plausibly beneficial to the speaker, who isn't trying to find the gap. The challenge for the speaker is to plan the structure, as discussed above. The EA structure allows the speaker to plan the initial wh-phrase without having planned the internal structure of the clause it's extracted from.

Based on an overview of data discussed in articles on LD structures, the following languages appear to have some kind of EA structure:

(2)
- a. Indo-European: German (Kvam 1983)
- b. Finno-Ugric: Hungarian (Marácz 1988; den Dikken 2009), Estonian (Allkivi 2015)
- c. Turkic: Turkish (Kornfilt 1997)
- d. Niger-Congo/Bantu: Bemba (Cheng 2006), Gichuka (Zentz 2015), Ikalanga (Letsholo 2002; 2011), Kinande (Schneider-Zioga 2000; 2007; Zentz 2016), Kĩîtharaka (Abels & Muriungi 2008; Zentz 2015), Shona (Zentz 2015; 2016), Zulu (Zentz 2015)
- e. Niger-Congo/Atlantic-Congo: Moore (Haïk 1990; Watanabe 1996), Wolof (Torrence 2013)
- f. Austronesian: Chamorro (Chung 1982; 1998), Malagasy (Pearson 2005), Palauan (Georgopoulos 1985; 1991), Tagalog (Rackowski & Richards 2005), Selayarese (Finer 1997)
- g. Afro-Asiatic: Berber (Stoyanova 2008; Henderson 2009), Hausa (Haïk 1990; Watanabe 1996), Somali (Stoyanova 2008)

The EA manifests itself differently depending on the language's morphosyntax. The next sections illustrate various types of EA structures.

3.1 Case switch

Case-marking on the wh-word poses a clear planning challenge for LD extraction structures, since the case on the wh-word depends on its grammatical function in the embedded clause. A speaker who is planning a sentence like *Who do you think that Jo saw*, for example, would need to have already planned the lower clause (which is part of

a different planning unit) at the point of planning the wh-word in order to ensure that it's in the correct form. Some languages with case-marking nevertheless allow LD extraction with the expected case-marking on the wh-word. Examples are question structures in Icelandic, Faroese, Yiddish, Finnish, Spanish, Catalan (optionally), Romani, and some dialects of German. However, in all dialects of German, the structure is ruled out in relative clauses, and several other languages on this list have a non-cased-marked relativizer.[1] It is also noteworthy that languages that lose case-marking over time seem to lose it on the wh-words before losing it on other pronouns. English (not counting the prescriptive *who/whom* distinction), Dutch, and the Mainland Scandinavian languages have some case distinctions in the pronouns, but not on the wh-words or relativizers.

The EA structure in a case-marking language is one where the case of the wh-word depends on the higher verb instead of the embedded clause. Den Dikken (2009), in his discussion of the structure in Hungarian, terms it *case switch*. For purposes of exposition, I will first illustrate case switch with a hypothetical example from English involving the prescriptive *who/whom* distinction. Style manuals (e.g., Strunk 2007; Hacker & Sommers 2011) indicate that *who* should be used for the subject and *whom* for the object. Interestingly, the short sections on this case distinction include the explicit direction that it be maintained in LD extraction structures, suggesting that people are prone to make errors in this situation. In fact, Huddleston & Pullum (2002: 466–7) discuss the case error, giving attested examples of the use of *whom* instead of *who* for LD subject extraction. Their examples are of LD extraction within a relative clause, where they claim that the error occurs more than in interrogatives. The example in (3) is a hypothetical example of the structure in an interrogative.

(3) a. "correct": *Who do you think wrote the book?*
b. "incorrect": *Whom do you think wrote the book?*

If the *who/whom* distinction were natural rather than prescriptive and if *whom* were grammatically required (rather than an error) in LD extraction, as in (3b), this would be an example of EA. The case on the fronted wh-word behaves as though it's determined by the higher verb, even though semantically, it relates to the lower verb. For the production process, this enables the speaker to plan the upper clause material with the wh-word without necessarily determining the structure of the lower clause material. For example, the speaker might decide to use an active or a passive (*whom do you think wrote the book* or *whom do you think the book was written by*); the sentence could be planned in clausal units without the form of the initial wh-word requiring a certain structure for the lower clause.

There is evidence for case switch EA in older German, based on examples and discussion from Blatz (1896), cited by Kvam (1983), such as (4).

(4) *German* (Kvam 1983: 37, ex. 4)
Wen lesen wir, daß dem Moses erschienen ist?
who.**ACC** read we that the.DAT Moses appeared is
'Who do we read appeared to Moses?'

[1] Yiddish (Jacobs 2005), Icelandic/Faroese (Thráinsson 2007), and Spanish/Catalan (Carme Picallo, personal communication) use an invariant relativizer, so the case-marking challenge does not arise in LD-movement in relative clauses. An additional factor in the case of Icelandic and Finnish (Huhmarniemi 2009) is that complement clauses in these languages are often non-tensed (subjunctive in Icelandic, and infinitival in Finnish). McDaniel et al. (2015) suggest that grammatically reduced complement clauses are likely to be planned jointly with the higher clause, which would facilitate extraction. Finally, German and Romani also have alternative structures, such as partial wh-movement, which avoid the planning challenge (McDaniel 1989).

In this example, the wh-word is extracted from the lower-clause subject position but is in the accusative case. Blatz described the phenomenon by stating that an extracted embedded subject can be grammatically linked to the higher verb as an object ("[kann] durch grammatische Rektion mit dem regierenden Verb als Objekt verbunden werden," Kvam 1983: 37).

The clearest example of case switch is the structure in Hungarian. Den Dikken (2009: 8) characterizes it as follows:

> "The fronted constituent in this pattern behaves very much like a constituent of the matrix clause: it controls definiteness agreement there, and also checks the upstairs verb's accusative Case feature. For some speakers … the fronted constituent does not even assert its morphological singularity within the clause to which it interpretively belongs."

In the following example, the subject is extracted, but the wh-word has accusative case.

(5) *Hungarian* (Marácz 1988: 211, ex. 13c)
Kit gondolsz hogy látta Jánost?
who.**ACC** think.2SG.INDF that saw.3SG.DEF John.ACC
'Who do you think saw John?'

The indefiniteness marking on the higher verb, as noted by den Dikken, is part of the same phenomenon, since it is agreeing with the wh-word as though extraction had been out of that clause.[2]

Estonian has case-switch to some degree as well, though the phenomenon is not as clear-cut as in Hungarian. Several different structures corresponding to LD extraction are possible, and there is variation across speakers (Allkivi 2015). For some speakers who accept LD extraction structures, case switch, as in Hungarian, is a possibility, though the non-switched case (nominative for LD subject extraction) is also possible. Some speakers allow a wh-copying structure, where the wh-word occurs in the scope position as well as at the front of the complement clause. In the case of subject extraction, both copies can have subject case-marking, as expected. But another possibility for some speakers is the EA structure, where the higher wh-word is marked with object (partitive) case. The structure, illustrated below, is referred to by Allkivi as *non-identical doubling*.

(6) *Estonian* (Allkivi 2015: 6, ex. 11)
Keda sa arvad, kes võidab?
who.**PART** you.NOM think.2SG who.**NOM** win.3SG
'Who do you think will win?'

3.2 Wh-agreement "switch"

In many languages, wh-movement is accompanied by special morphology on the verb. In LD extraction, there is variation in which verb shows the wh-agreement. When it occurs on the verb of the extraction clause, it provides evidence for successive cyclic movement. Because of this, the default expectation is often framed as being that the morphology would be on the higher verb (so the lower verb's marking argues for successive cyclicity). But an approach starting from a descriptive comparison of the SD and LD structures might predict the opposite, namely that the morphology of the LD lower clause would reflect the

[2] Some Hungarian speakers reject LD wh-movement, only accepting the more common partial wh-movement structure.

morphology of the corresponding SD structure, since the extraction clause is the one that the wh-phrase relates to semantically. The lower clause of *Who do you think ate the cake?* for example, is the one that parallels *Who ate the cake?* I use the term *wh-agreement switch* to refer to the situation where wh-agreement in an extraction structure is with the higher verb. It is an EA structure, since, like case switch, it means that the extracted element is integrating with the higher verb rather than the verb of the extraction clause, allowing the speaker to plan the higher clause on a par with a SD wh-structure.

Shona is an example of a language that clearly manifests wh-agreement switch. In Shona, the verb in non-subject extraction structures agrees in φ-features with the extracted element, as shown in the following example (Zentz 2015; 2016).

(7) *Shona* (Zentz 2016: 170, ex. 3.63a)
Ndi-Ø-ani wa-v-aka-teng-er-a Ø-rokwe ku-chi-toro nezuro?
NI-1a-who 1a.**WH [NSBJ]** -2.SM-TA-buy-APPL-FV 5-dress 17-7-store yesterday
'Who did they buy a dress (for) at the store yesterday?'

Here the prefix *wa-* on the verb occurs obligatorily to agree with the fronted wh-phrase. In LD movement, however, the wh-agreement "switches" to the higher verb, as shown in (8).

(8) *Shona* (Zentz 2016: 171, ex. 3.64a)
Ndi-Ø-ani wa-w-ai-fung-a kuti v-aka-teng-er-a
NI-1a-who 1a.**WH [NSBJ]** -2SG.SM-TA-think-FV that 2.SM-TA-buy-APPL-FV
Ø-rokwe ku-chi-toro nezuro?
5-dress 17-7-store yesterday
'Who did you think they bought a dress (for) at the store yesterday?'

Here, the obligatory agreement prefix occurs on the higher verb *think* and may not occur on the verb *buy*.

The EA phenomenon is even more striking in the comparison of SD and LD subject extraction. In SD subject extraction, the verb does not include the wh-agreement prefix, but instead inflects with a tonal change indicating subject extraction. This is illustrated in (9).

(9) *Shona* (Zentz 2016: 179, ex. 3.73a)
Ndi-Ø-ani à-ka-teng-er-a Ø-Thandi Ø-rokwe ku-chi-toro
NI-1a-who 1a.SM(**WH [SBJ]**)-TA-buy-APPL-FV 1a-Thandi 5-dress 17-7-store
nezuro?
yesterday
'Who bought Thandi a dress at the store yesterday?'

LD subject extraction, on the other hand, looks just like SD non-subject extraction; the higher verb has the non-subject wh-agreement prefix and the lower verb has usual (non-wh) morphology with no tonal change, as shown in (10).

(10) *Shona* (Zentz 2016: 182, 3.77a)
Ndi-Ø-ani wa-w-ai-fung-a kuti a-ka-teng-er-a
NI-1a-who 1a.**WH [NSBJ]** -2SG.SM-TA-think-FV that 1a.SM-TA-buy-APPL-FV
Ø-Thandi Ø-rokwe ku-chi-toro nezuro?
1a-Thandi 5-dress 17-7-store yesterday
'Who did you think bought Thandi a dress at the store yesterday?'

These examples in Shona are clear cases where the beginning of the LD question is like a non-subject SD question; *who do you think* is morphologically parallel to *who do you*

admire. The higher verb articulates with the fronted wh-word and no subject/non-subject distinction needs to be made at the outset.

Similar EA structures occur in other Bantu languages (Zentz 2015: 297 lists Kĩîtharaka, Gichuka, Ikalanga, and Zulu). In Ikalanga, for example, a wh-agreement morpheme occurs in both subject and non-subject extraction structures, replacing the usual subject agreement in SD subject extraction (Letsholo 2002; 2011). In LD extraction, however, the higher verb has the wh-agreement marker, as in Shona, and the verb of the embedded clause has usual subject agreement, which, in the case of LD subject extraction, is with the extracted element. This is illustrated below.

(11) a. *Ikalanga* (Letsholo 2002: 193, ex. 70a)
Ndi-ani wa-ka-bona mbisana?
FOC-who.1 **WH**-PST-see boy
'Who saw a/the boy?'

b. *Ikalanga* (Letsholo 2002: 193, ex. 70b)
Ndi-ani Neo wa-a-ka-bona?
FOC-who.1 Neo **WH**-SA-PST-see
'Who did Neo see?'

c. *Ikalanga* (Letsholo 2002: 217, ex. 114a)
Ndi-ani Neo wa-a-no-alakana kuti u-noo-wina?
FOC-who.1 Neo **WH**-SA-PRS-think that SA1-will-win
'Who does Neo think will win?

The Ikalanga LD structure is an example of EA for the following reasons: The wh-agreement morphology occurs on the verb of the clause where the wh-element occurs, there is no difference in the upper clause between subject and non-subject extraction, and the structure of the upper clause is morphologically parallel to the structure of SD non-subject extraction.

Haïk (1990: 351), analyzing wh-movement in Palauan, Hausa, Kikuyu, and Moore, notes that all of the researchers whose work on these languages she cites "have pointed out that the [morphological] alternation must be determined by syntactic rather than semantic factors, since it is the surface position of the operator that is relevant to INFL and not its LF, or logical, position." This refers to the EA structure, where the wh-morphology occurs on the verb where the wh-phrase occurs. In Moore and one dialect of Hausa, the morphology occurs only on the higher verb, whereas in Kikuyu, Palauan, and another dialect of Hausa, it occurs on both the higher verb and the lower verb(s).

In Moore, for example, wh-morphology manifests as irrealis marking on the verb of the higher clause. The verbs of embedded clauses, including the one the wh-phrase is extracted from, are realis. This is illustrated in the following examples.

(12) *Moore* (Haïk 1990: 354, ex. 12a)
Bwɛ̃ la fo yeel t' a Bil ri-I zaame?
what FOC 2SG say.**IRR** that Bila eat-**R** yesterday
'What did you say that Bila ate yesterday?

The EA structures in the Austronesian languages Tagalog, Palauan, and Chamorro are similar, but more striking, since wh-agreement in these languages makes case distinctions. The following example from Tagalog shows that the higher verb has wh-object agreement even though the extracted element is a subject (Rackowski & Richards 2005; Boeckx 2008).

(13) *Tagalog* (Boeckx 2008: 126, ex. 13a)
Sino ang sinabi ng magsasaka na kumain ng bulaklak?
who ANG **ACC**.said NG farmer that **NOM**-ate NG flower
'Who did the farmer say ate the flower?'

In Palauan, wh-agreement shows up in the distribution of the realis/irrealis marking on the verb, which works differently for subject and non-subject extraction (Georgopoulos 1985). In SD subject extraction, the verb has usual, realis, morphology, but loses its subject agreement marking. In SD non-subject extraction, the verb agrees with the subject, but is marked as irrealis. This is illustrated in (14).

(14) a. *Palauan* (Georgopoulos 1985: 67, ex. 10a)
Ng-te?a a kileld-ii a sub?
CL-who **R**.PF.heat-3SG[OBJ] soup
'Who heated up the soup?'

b. *Palauan* (Georgopoulos 1985: 67, ex. 10b)
Ng-ngera a le-silseb-ii a se?el-il?
CL-what **IRR**.3[SBJ]-PF.burn-3SG[OBJ] friend-3SG
'What did his friend burn?'

The LD structure manifests EA in that the verbs of the higher and lower clauses are clearly marked independently. Wh-agreement is marked in all clauses along the extraction path, but the subject/object distinction (realis vs. irrealis) of the extraction site is only reflected on the verb of the extraction clause itself. Examples are given in (15).

(15) a. *Palauan* (Georgopoulos 1985: 81, ex. 20b)
Ng-te?a a l-ilsa a Miriam el milnguiu a buk er ngii?
CL-who **IRR**.3[SBJ]-PF.see Miriam COMP **R**.IMPF.read book P her
'Who did Miriam see reading her book?'

b. *Palauan* (Georgopoulos 1985: 81, ex. 20a)
Ng-ngera a ?om-ulemdasu el l-ulengiil er ngak el
CL-what **IRR**.2[SBJ]-PF.think COMP **IRR**.3[SUBJ]-wait P me COMP
bo k-uruul er ngii?
IRR.FUT **IRR**.1SG[SBJ]-IMPF.do P it
'What do you think that they were waiting for me to do?'

Georgopoulos, having analyzed the realis/irrealis distinction as (abstract) case agreement, characterizes the LD facts as follows:

> "While it is always true that a verb agrees with the Case of a variable that is within the same S, not every verb within the dependency does so. Rather, verbs in higher clauses register agreement with the Case of *the sentential complement containing the variable*, and do not agree with the variable itself" (Georgopoulos 1985: 80, emphasis in original)."

To illustrate this further, Georgopoulos gives the following examples of topicalization structures where the clause containing the extracted element is a subject rather than a complement.

(16) a. *Palauan* (Georgopoulos 1985: 80, ex. 19a)
Mary a kltukl el kmo ng-otoir er a John.
Mary **R**.clear COMP **R**.3SG[SBJ]-IMPF.love P John.
'Mary, [it's] clear (that) loves John.'

b. *Palauan* (Georgopoulos 1985: 80, ex. 19b)
John a ʔemolt el l-oltoir er ngii a Mary.
John **R**.obvious COMP **IRR**.3[SBJ]-IMPF.love P him Mary
'John, [it's] obvious that Mary loves (him).'

In this case, the higher verb is treated like an SD subject extraction structure with respect to wh-agreement (lacking the irrealis marking). The parallel used up to this point to illustrate the EA phenomenon has been between the SD *who do you admire* and the LD beginning *who do you think*. In subject clause examples like (16), the parallel would be between an SD structure like *who is nice* and the LD beginning *who is [it] obvious*. The parallelism again allows the speaker to plan the beginning of the LD structure without having planned the internal structure of the clause the element is extracted from.

Chamorro has a similar EA structure. Wh-agreement on the verb reflects the case of the wh-phrase, but, as stated by Chung (1998: 249–250), the verbs in the higher clauses "are not inflected for the Case of the initial Wh-trace [but] for the Case of the intermediate CP out of which Wh-movement has most immediately occurred." This is shown in the following examples.[3]

(17) a. *Chamorro* (Chung 1998: 250, ex. 85a)
Hayi si Manuel hinassóso-nña chumuli' i salappi'?
who Manuel **WH [OBJ]** .think.PROG-AGR **WH [NOM]** .take the money
'Who does Manuel think has taken the money?'

b. *Chamorro* (Chung 1982: 54, ex. 45a)
Hafa um-istotba hao ni malogo'-ña i lahi-mu?
What **WH [NOM]** -disturb you COMP **WH [OBL]** .want-AGR the son-your'
'What does it disturb you that your son wants?'

Chung (1982) gives examples showing that verbs of intermediate clauses behave the same way, marking wh-agreement depending on the grammatical function of the complement clause, as in (18).

(18) *Chamorro* (Chung 1982: 58, ex. 56)
Hayi sinangane-nña si Antonio nu hämi ma'a'ñao-ña pära
who **WH [OBJ]** .say.DAT-AGR Antonio OBL us **WH [OBL]** .fear-AGR FUT
u-chiku?
3SG-**WH [OBJ]** .kiss
'Who did Antonio tell us that he is afraid to kiss?'

Here the highest verb is marked for wh-object agreement, since its complement is an object (*tell something*), the intermediate verb has wh-oblique agreement, since the complement of this predicate is oblique (*be afraid of something*); and the lower verb has object agreement because the extracted element is an object (*kiss someone*). If this account is correct, this indicates that the planning process this structure derives from is one that proceeds in clausal units, where the speaker indicates each time that it's a wh-question but only needs to integrate the wh element with the current clause.

4 Other types of LD extraction structures

Although EA structures are likely to be relatively rare cross-linguistically, it is important to note that many other LD extraction structures are compatible with this account, in particular, any LD extraction structure that allows the speaker to plan the wh-phrase and the

[3] For consistency, the glosses of the wh-agreement markers in the examples from Chung (1982) were changed to follow the system used in Chung (1998).

higher clause without committing to the structure of the extraction clause. This situation occurs in any language where the morphology doesn't mark for the grammatical function of the wh-phrase, regardless of whether there are other types of agreement with the extracted phrase. English is an example of such a language, since *who do you think [CP]* can be planned without committing to the internal structure of the CP.[4] Other examples are given in (19).

(19) a. no wh-agreement/case morphology of any kind
Dutch (Schippers 2016: 342, ex. 7)
Wie denk je dat het verhaal aan Jan heeft verteld?
who think you that the story to Jan has told
'Who do you think has told the story to Jan?'

b. non-case-distinguishing wh-agreement in every clause
Ojibwe (Lochbihler & Mathieu 2008: 18, ex. 12)
Aniish Bill gaa-eneendang John gaa-kedat Mary gaa-giishnedot?
what Bill **WH**.PST-think John **WH**.PST-say Mary **WH**.PST-buy
'What does Bill think John said Mary bought?'

c. wh-agreement only in extraction clause
French (Grohmann 2003: 254, ex. 60)
Quelles chaises as-tu dit/(*dites) qu'il a
Which.FEM.PL chair.FEM.PL have-you said/(*said.FEM.PL) that-he has
repeintes?
painted.FEM.PL
'Which chairs did you say that he painted?

In structures like (19a) and (19b), *who do you think* is morphologically parallel to *who do you admire*, as in English, since there is either no agreement in SD or LD structures (Dutch) or the agreement is the same for SD and LD structures and for subject and object extraction (Ojibwe). The fact that agreement is also required in the extraction clause in Ojibwe is not consequential, since the speaker plans that clause with the extracted wh-phrase in mind. The structure illustrated in (19c) might seem problematic, since in this case, *which chairs did you say* is morphologically different from *which chairs did you paint?* This is because the gender agreement would occur in the SD extraction structure. However, the lack of agreement on the higher verb doesn't create a planning challenge; it only means that the speaker is aware that it's an LD extraction structure. The speaker still does not need to plan the internal structure of the complement clause at the outset. It is important here to clarify that planning *who do you think…* on a par with *who do you admire* does not mean that the speaker is unaware of the complement CP in the LD structure; rather, it means that the speaker does not have to commit to its internal structure. This point is discussed in more detail in Section 5.

The account is also compatible with the alternatives to LD extraction that are listed in (1), though a detailed discussion is beyond the scope of this paper. Many of these cases could be accounted for in terms of either production or parsing; in other words, the two processing systems would push in the same direction.

[4] English LD extraction might also be analyzed as a case of EA. The English *do*-support pattern is reminiscent of the wh-agreement pattern in Ikalanga, as noted by Letholo (2002: 200); *do* occurs in SD object extraction, as well as LD subject and object extraction, whereas it does not occur in SD subject extraction (**Who did eat the cake?*). If the absence of *do* in SD subject extraction indicates the non-occurrence of Tense raising, then Tense raising could be characterized as marking non-subject extraction, in which case LD subject extraction would pattern with non-subject extraction. However, the EA analysis is questionable in this case, since in structures with auxiliaries, there is no morphological difference between subject and object extraction (*Who is calling Jo?*, *Who is Jo calling?*).

The question arises of the kinds of structures this account would *not* handle. In other words, what kinds of counterexamples would challenge it? As mentioned in Section 3.1, some case-marking languages allow for non-EA LD extraction. If this kind of structure occurred freely within languages and widely cross-linguistically, it would be problematic for the account. But, as noted, the structure is limited in the languages that allow it. In terms of wh-agreement morphology, counterexamples would be structures where wh-agreement occurred on the verb of the higher clause to indicate the grammatical function of the element extracted from a lower clause. No reports of any such examples were found.

5 Broad significance of EA

I will first consider in more detail how the EA structure addresses the planning challenge of the LD extraction structure. The consequence of the EA structure is morphological parallelism between an SD extraction structure and the higher clause of the LD extraction structure. However, the parallelism is likely limited to the overt morphology; the syntactic structure of the SD and LD structures will differ, since the argument structure of the higher verb does not include both the wh-phrase and the embedded clause it's extracted from. The syntactic analysis of the structure (which may vary across languages) will account for how the wh-phrase ends up being morphologically treated as though it's the clausal argument of the verb. For example, den Dikken (2009) proposes that in Hungarian the wh-phrase extracts from the higher clause and binds a null pronoun in the embedded clause. Letsholo (2002) proposes that wh-agreement in Ikalanga results from the wh-phrase moving to the FocP through the specifier of a Polarity Phrase, accounting for why the agreement shows up on the verb of the clause where the wh-phrase is pronounced. Whichever syntactic account is correct for a given language, that structure needs to be planned by a speaker producing an LD extraction structure. But regardless of the structure, the advantage to the speaker is not having to plan the internal structure of the extraction clause at the outset. In other words, in planning a sentence like *Who do you think Jo admires?* the speaker can plan the first major unit, which is the part down to the CP: *Who do you think CP*, saving the internal structure of the CP for a later step in the process.

A further question is how the EA structure would have arisen. The general idea is that the various cross-linguistic morphosyntactic devices (listed in (1)) arise from the grammar's response to the processing challenge posed by LD extraction. In other words, these can be seen as a kind of grammaticalization. Put in terms of a sequence of steps, the process would be something like the following: Merge allows for long-distance dependencies; but LD extraction is challenging for the processors; so the language uses morphosyntactic devices to limit LD extraction. In the specific case of EA, the sentence formulation process would be faced with morphology that would normally require early planning of an embedded clause. To counteract this, the language adopts a morphosyntactic structure that allows for the extracted element to be morphologically treated as a constituent of the higher clause.

It is important to emphasize that the EA is not in itself a syntactic account of LD extraction in a particular language with this structure. Rather, this account is compatible with a variety of syntactic analyses. The goal here is not to choose among syntactic analyses or to provide a new one, but to find an explanatory account of why languages have gone in this particular direction. The idea is that the processors play a role in shaping languages' instantiations of UG.

From an evolutionary perspective, the claim is that morphosyntactic devices beyond the basic innovation (e.g., Merge) would have evolved in tandem with the processing systems

as part of the process of externalization. The processing systems would have developed procedures to deal with the grammar (combined with extra-grammatical pressures, such as memory limitations), and the evolution of these procedures (such as clause-by-clause planning) would in turn shape the further evolution of the morphosyntax. This process would result in a UG that is more flexible than the parameters model.

Before concluding, I consider the strengths of this account. It's important here to distinguish between the account of the EA structure specifically and the general claim that sentence planning pressures affect grammatical structure. The EA phenomenon on its own may not argue convincingly for the general claim, but it adds to a growing body of evidence in support of it. As far as the specific account, it unifies and provides an explanation for a class of cross-linguistically occurring structures that are otherwise mysterious, unexpected both syntactically and semantically, and apparently in conflict with parsing considerations. The account also provides an explanation of why languages tend to resist LD movement (illustrated in (1)), though, as mentioned earlier, an account in terms of parsing would handle many of these cases as well. The production account could be further explored by studying LD extraction structures in experiments on language production; the prediction is that speech errors and other indicators of difficulty, such as dysfluency, should occur more in LD structures that involve non-EA overt morphology (such as non-switched case-marking of a fronted wh-word) than in other types of LD structures, including EA structures. Furthermore, when both kinds of structure occur in a language (which seems to be the case in Estonian, as discussed above), the prediction is that the EA structure will be used with greater frequency.

6 Conclusion

The EA structure, which occurs in a wide variety of languages and manifests itself in various ways morphologically, is unexpected grammatically, since the extracted phrase articulates with the clause where it is pronounced instead of with the clause it is extracted from. Embracing the claim that the processing systems play a role in shaping grammars, I have argued that the EA structure points specifically to the role of the sentence production system.

Abbreviations

Affixes glossed as numbers (sometimes with letters) in the Bantu examples indicate noun class.

2SG = second person singular, 3SG = third person singular, ACC = accusative, AGR = agreement, APPL = applicative, CL = cleft, COMP = complementizer, DAT = dative, DEF = definite, FEM = feminine, FOC = focus, FUT = future, FV = final vowel, IMPF = imperfective, INDF = indefinite, IRR = irrealis, NI = reflex of proto-bantu copula **ni*, NOM = nominative, NSBJ = non-subject, OBJ = object, OBL = oblique, PART = partitive, PF = perfective, PL = plural, PROG = progressive, PRS = present, PST = past, R = realis, SA = subject agreement, SBJ = subject, SE = subject extraction, SM = subject marker, TA = tense/aspect, WH = wh agreement

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Competing Interests

The author has no competing interests to declare.

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