

On Non-Finite Relative Clauses*

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1. Introduction

Finite relative clauses, exemplified in (1), have been one of the most extensively discussed syntactic constructions.

- (1) Where is the CD [that I bought yesterday]?

To date, two main analyses have been proposed to derive finite relative clauses. One is the Operator Movement Analysis (OMA; Chomsky (1977), among others), and the other is the Head Raising Analysis (HRA; see Schachter (1973), Kayne (1994), and others). The OMA and HRA are shown in (2a, b), respectively.

- (2) a. [DP the [NP [NP CD]_i [CP OP_i that [TP I bought t_i yesterday]]]]
b. [DP the [CP [NP CD]_i that [TP I bought t_i yesterday]]]

In (2a), the null operator moves from the object position to the specifier position of CP, and then the relative clause CP adjoins to the antecedent NP *CD*. The null

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operator establishes the predication relation with the NP, which is indicated by the subscript *i*, so that *CD* is interpreted as the complement of the verb *bought*. In (2b), the antecedent NP *CD* is base-generated in the object position and then moves to the specifier of CP. In this way, finite relative clauses have been analyzed in two different ways.¹ Each of the analyses has supporting evidence and therefore, some researchers argue that finite relative clauses are ambiguous between the OMA structure and the HRA structure (for example, Sauerland (2000), Aoun and Li (2003), Miyamoto (2010)). Let us assume that this argument is correct. The question then arises of whether non-finite relative clauses are derived by the OMA or the HRA in the same way as finite relative clauses. In this paper, we deal with infinitival relative clauses (IRCs) and reduced relative clauses (RRCs), both of which are non-finite relative clauses. These relative clauses are exemplified in (3).

- (3) a. Give me something [to eat].
 b. Do you know the guy [wearing the green suit]?

The infinitival clause in (3a) is an IRC that modifies the NP *something*. The participial clause in (3b) is an RRC that modifies the NP *guy*. We agree with Tozawa (2017, 2019) that RRCs are derived by the HRA. Since Tozawa deals with the derivation of RRCs, this paper pays more attention to IRCs, arguing that they can be derived by the OMA or the HRA. The analyses of IRCs and RRCs that we propose are summarized in (4).

(4)

	How to derive non-finite relative clauses
Infinitival Relative Clauses	OMA or HRA
Reduced Relative Clauses	HRA

We compare IRCs with RRCs and demonstrate that a syntactic difference between IRCs and RRCs follows from the difference in how the relative clause is derived. The remainder of this paper is organized as follows. Section 2 re-

views Chomsky's (2013, 2015) labeling algorithm. Section 3 presents previous analyses of IRCs. Section 4 makes a proposal about the derivations of IRCs and RRCs. Section 5 explores the consequences of our proposal. Finally, Section 6 concludes the paper.

2. Theoretical Framework

We adopt Chomsky's (2013, 2015) labeling algorithm and discuss it in this section. Chomsky proposes the labeling algorithm (LA) based on the operation of minimal search, a third factor principle. Minimal search looks for a lexical item which provides the label of a syntactic object (SO). As for the label of the SO consisting of H and XP, Chomsky writes as in (5).

- (5) Suppose $SO = \{H, XP\}$, H a head and XP not a head. Then LA will select H as the label, ... (Chomsky 2013: 43)

Minimal search first finds the lexical item H; therefore, the label of $\{H, XP\}$ is H rather than X. What then is the label of $\{XP, YP\}$, where neither XP nor YP is a lexical item? Minimal search locates both X and Y, so the label of $\{XP, YP\}$ is undetermined. Chomsky argues that there are two ways to label the SO $\{XP, YP\}$, indicated in (6).

- (6) (A) modify SO so that there is only one visible head, or (B) X and Y are identical in a relevant respect, providing the same label, which can be taken as the label of the SO. (Chomsky 2013: 43)

The first way to label $\{XP, YP\}$ is to move XP or YP. Assume that XP undergoes movement, as shown in (7).

- (7) [... XP₁ ... [_α XP₁ YP]]

Note that the XP of $\{XP, YP\}$ is a copy. If we assume that copies are invisible

to the LA, only the YP of {XP, YP} is visible to the LA. Therefore, α is labeled as Y.

The second way to label {XP, YP} relates to the most prominent features shared by X and Y. For example, consider the label of {DP, TP} in (8).

$$(8) \quad [_{CP} C [_{\alpha} DP_i [_{TP} T [_{vP} DP_i v \dots]]]]$$

DP internally merges with TP, forming {DP, TP}. Note that DP and TP share prominent features: ϕ -features. Minimal search then finds the ϕ -features shared by DP and TP. Therefore, ϕ -features are the label of α in (8).

3. Previous Analyses of Infinitival Relative Clauses

3.1. The Operator Movement Analysis

Although there are not many papers that deal with the derivation of IRCs, most argue for the OMA (e.g. Chomsky (1980)).² The IRC in (9a) has the structure shown in (9b).

- (9) a. She is looking for a fountain pen to write a letter with.
 b. $[_{DP} a [_{NP} [_{NP} \text{fountain pen}]_i [_{CP} OP_i \text{ to write a letter with } t_i]]]$

As shown in (9b), the null operator moves to CP and is co-indexed with the relative clause head *fountain pen*, which is thereby interpreted as the complement of the preposition *with* in the IRC. It is true that the OMA can capture the basic properties of IRCs but it cannot account for the fact that the relative clause head can be reconstructed to the IRC. Consider (10).

- (10) The picture of himself_i for Tom_i to buy is for sale.

In (10), *Tom* in the IRC can refer to *himself* in the relative clause head. This indicates that the head *picture of himself* is reconstructed to the IRC. However, the OMA cannot account for why reconstruction of the relative clause head can

take place. Under the OMA, the IRC in (10) has the structure shown in (11).

- (11) [the [_{NP} [_{NP} picture of himself]_i] [_{CP} OP_i for [_{TP} Tom_j to buy *t*_i]]]]

The relative clause head *picture of himself* is not base-generated in the IRC and therefore, *himself* cannot be bound by *Tom* at any stage of the derivation. Thus, the OMA incorrectly predicts that (10) is ungrammatical in violation of Condition A.

3.2. The Operator Movement Analysis and the Head Raising Analysis

Hackl and Nissenbaum (2012) argue that non-subject IRCs with *should*-readings are derived by the HRA or the OMA, while non-subject IRCs with *could*-readings are derived by the HRA.³ Note that non-subject IRCs are IRCs whose heads are not a subject in the IRC. This is exemplified in (12).

- (12) I have [some pictures to show you].

The relative clause head *some pictures* functions as the object rather than the subject in the IRC. According to Hackl and Nissenbaum (2012), non-subject IRCs have two modal readings: *should*-readings and *could*-readings. The IRC in (12) can be paraphrased as in (13a) or (13b).

- (13) a. I have some pictures that I should show you. (*should*-reading)
 b. I have some pictures that I could show you. (*could*-reading)

The non-subject IRC is ambiguous between the *should*-reading in (13a) and the *could*-reading in (13b).⁴ With this in mind, let us return to Hackl and Nissenbaum's argument. They contend that *should*-readings have the OMA structure or the HRA structure, whereas *could*-readings have the HRA structure. They provide several pieces of evidence for their argument, one of which concerns binding facts. Consider (14).

- (14) There are many facts about John_i [for him_i to tell his superiors].
 (only *should*-reading)
 (cf. Hackl and Nissenbaum 2012: 69)

The IRC in (14) has only a *should*-reading if *John* and *him* refer to the same person. The *could*-reading is impossible, because the *could*-reading has an HRA structure. The HRA and OMA structures of the IRC are shown in (15a, b), respectively.

- (15) a. [many [CP [NP facts about John_j]_i for [TP him_j to tell his superiors *t_i*]]]
 b. [many [NP [NP facts about John_j]_i [CP OP₁ for [TP him_j tell his superiors *t_i*]]]]]

In (15a), where the IRC is derived by the HRA, the relative clause head NP *facts about John* is base-generated in the object position of the IRC and then moves to CP. The HRA structure can make the *could*-reading available. However, this derivation in (15a) violates Condition C because *John* is bound by *him* in the IRC. Therefore, the *could*-reading is not allowed in (14). Note that the *should*-reading has the OMA structure as well as the HRA structure. In the OMA structure in (15b), the relative clause head NP does not appear in the IRC. This structure satisfies Condition C. Therefore, the *should*-reading is possible in (14). Hackl and Nissenbaum also demonstrated that their argument is supported by Condition A effects. Consider (16).

- (16) a. There are many facts about himself_i [for John_i to tell his superiors].
 (both *should*-reading and *could*-reading)
 (cf. Hackl and Nissenbaum 2012: 69)
 b. [many [CP [NP facts about himself_j]_i for [TP John_j to tell his superiors *t_i*]]]

(16a) shows that the relative clause head *facts about himself* is reconstructed to

the IRC, so that the reflexive pronoun *himself* is licensed by its antecedent *John*. In this case, the IRC can have both the *should*-reading and the *could*-reading. Because the HRA structure is available for the *should*-reading and the *could*-reading, we can give a straightforward account for the fact in (16a). Specifically, the IRC has the structure shown in (16b). The relative clause head *facts about himself* is base-generated in the object position. The antecedent *John* in the subject position then binds *himself*. Consequently, the HRA structure satisfies Condition A. Therefore, the IRC has both the *should*-reading and the *could*-reading. Although we are in favor of the idea that non-subject IRCs can be derived by the OMA or the HRA, there are two problems with Hackl and Nissenbaum's argument.

First, it may be controversial whether the *could*-reading has only the HRA structure. Bhatt (1999) points out that there is a case where the reconstruction of the IRC head does not always occur in the *could*-reading. Consider (17).

- (17) There are many movies by Mimi_i's friends for her_i to watch at the Ritz this weekend. (both *could*-reading and *should*-reading)
(cf. Bhatt 1999: 171)

In (17), *Mimi* and *her* can be coreferential even in the *could*-reading. This shows that the *could*-reading can have the OMA structure.

Second, the HRA is not compatible with the LA. Hackl and Nissenbaum (2012) adopt Kayne's (1994) HRA according to which the relative clause head NP moves to CP. Consider (18).

- (18) [DP the [?? NP_i [CP C [TP ... t_i ...]]]]

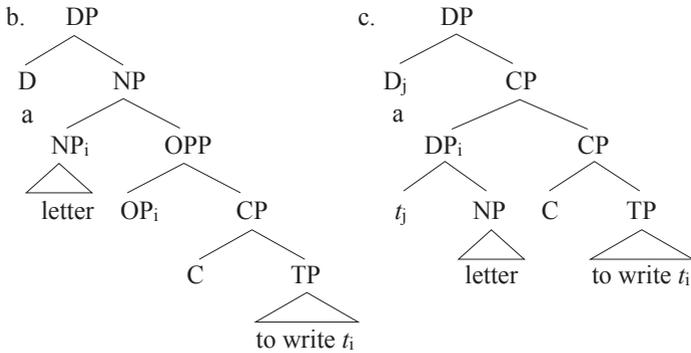
The relative clause head NP undergoes movement to CP. It is important to note that Internal Merge of NP with CP creates the XP-YP structure: {NP, CP}. According to the LA, {NP, CP} cannot be labeled; therefore, it cannot be interpreted at the interfaces. Therefore, so far as we adopt the LA, we have to modify Kayne's HRA in order to conform to the labeling theory.

In the next section, we make a proposal regarding the derivation of non-finite relative clauses.

4. A Proposal

We propose that non-subject IRCs are derived by the OMA or the HRA, regardless of whether the IRC has a *should*-reading or a *could*-reading. For example, the IRC in (19a) has the structures in (19b, c).

(19) a. She had a letter to write.

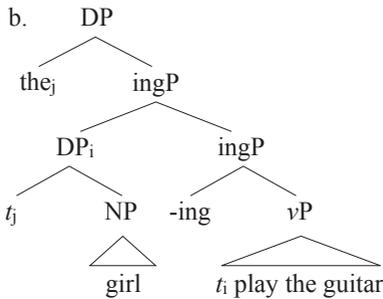


IRC's are structurally ambiguous between the OMA and HRA structures. The IRC in (19b) has the OMA structure. It is CP and the null operator moves to CP, forming the SO {OP, CP}. Let us assume that the null operator is a lexical head.⁵ {OP, CP} is then labeled as OP, in conformity with the LA in (5). Next, the OPP adjoins to the relative clause head NP *letter*. Finally, on the basis of Abney's (1987) DP hypothesis, the D head *a* merges with NP, forming DP.⁶ Let us now turn to the HRA structure in (19c). The relative clause head *a letter* is base-generated in the relative clause and then, moves to CP to form {DP, CP}. Note that {DP, CP} cannot be labeled because it is an XP-YP structure. We agree with Tozawa (2017, 2019) that the unlabeled structure is avoided by movement of the D head *a*. Movement of D makes the D head of {DP, CP} a copy, which makes the D head invisible to labeling. Then, only the C head of

{DP, CP} is visible to the LA, and {DP, CP} is labeled as C. When the D head moves to CP to form {D, CP}, the label of {D, CP} is D, according to the LA. In this way, the IRC is derived by the OMA or the HRA.⁷

As for the derivation of RRCs, we follow Tozawa (2017, 2019) in arguing that RRCs are derived by the HRA. The RRC in (20a) has the structure shown in (20b).

(20) a. I know the girl playing the guitar.



RRC is the ingP headed by the participial *-ing*. The relative clause head DP moves to ingP. The SO {DP, ingP} cannot be labeled. The label indeterminacy is avoided by further movement of the D head *the*, which makes only *-ing* of {DP, ingP} visible to labeling.⁸ Therefore, the label of {DP, ingP} is *-ing*. It is important to note that RRCs are different from IRCs in that they lack the CP projection.⁹ The participial *-ing* is the element of the TP domain and RRCs have no projection above ingP. There are three pieces of evidence that RRCs have no CP, while IRCs have CP. The first is the distribution of the complementizer. Consider (21).

(21) a. A man [(**that*) working for John] visited us yesterday.

(cf. Krause 2001: 27)

b. The man [for you to see] is Mr Johnson.

As indicated in (21a), the complementizer *that* cannot occur in the RRC. In

contrast, the prepositional complementizer can appear in the IRC as observed in (21b). These facts support that RRCs lack CP, whereas IRCs have CP. The second piece of evidence comes from the distribution of the relative operator. Let us consider (22).

- (22) a. A man (*who) working for John visited us yesterday.
(cf. Krause 2001: 27)
- b. She is not a person [on whom to rely].

The relative operator cannot occur in the RRC, whereas it can occur in the IRC. Given that relative operators occupy the specifier of CP, (22a, b) support that CP is absent in RRCs, while it is present in IRCs.¹⁰ The third piece of evidence concerns the distribution of CP adverbs. Consider (23) and (24) as follows:

- (23) a. * I met the boy [reading the book *evidently*].
b. *?I met the boy [reading the book, *unfortunately*].
- (24) a. He has many things [to do *evidently*].
b. ?I will bring a person [for you to talk with, *unfortunately*].

In (23a, b), the adverbs *evidently* and *unfortunately* cannot appear in the RRC. In contrast, they can occur in the IRC, as in (24a, b). We assume with Cinque (1999) that *evidently* and *unfortunately* are CP adverbs. We can then attribute the contrast between (23) and (24) to the presence or absence of CP in the relative clause. Specifically, the RRC lacks CP, so there is no position for the adverb to adjoin to. Therefore, the sentences in (23) are ungrammatical. Meanwhile, the IRC has CP for the adverb to adjoin to. Thus, the sentences in (24) are grammatical.

In the next section, we will show that we can account for the syntactic similarities and differences between IRCs and RRCs on the basis of our proposal.

5. Consequences

5.1. Idiom Chunks

It is generally assumed that nominal parts of idiom chunks must originate as a complement of the verb and cannot appear independently from the verb.

- (25) a. We made headway.
 b. *(The) headway was satisfactory. (Schachter 1973: 31)

In (25a), the nominal part *headway* of the idiom chunk *make headway* is generated as the complement of the verb *make*. The ungrammaticality of (25b) shows that *(the) headway* cannot occur without *make*. Here, we consider the case in which the nominal part is the relative clause head.

- (26) [DP_i [relative clause ... $\underbrace{V DP_i}_{\text{idiom chunk}}$...]]

Suppose that V and DP form an idiom chunk in the relative clause. The HRA argues that the nominal part moves from within the relative clause to the antecedent position, leaving its copy behind. Although the nominal part is not in the complement position of the verb in the surface string, its copy is the complement of the verb. Therefore, the nominal part can be the relative clause head under the HRA. We argue that the HRA is available for IRCs and RRCs. Therefore, we predict that IRCs and RRCs allow the nominal part to be relativized. This prediction is borne out.

- (27) a. The strings to pull to get him a part in that film are frankly too many. (Cinque 2020: 202)
 b. I was surprised at the headway being made by Mary.¹¹

(27a) indicates that the nominal part of the idiom chunk *pull strings* in the IRC can be relativized. Likewise, (27b) shows that it is possible to apply relativiza-

tion to *headway* of *make headway* in the RRC. The derivations of the IRC and the RRC are illustrated in (28a, b).

- (28) a. [DP the_j [CP [DP t_j strings]_i [CP C [TP to pull t_i [to get him a part in that film]]]]]]
 b. [DP the_j [ingP [DP t_j headway]_i [ingP -ing [be made t_i by Mary]]]]]

In (28a), the nominal part *the strings* originates as the complement of *pull* in the IRC and then moves to CP, forming {DP, CP}. {DP, CP} cannot be labeled because it is an XP-YP structure. The label indeterminacy is avoided by the further movement of *the*, which makes the D head a copy. Since copies are invisible to the LA, only C of {DP, CP} is visible to the LA. Therefore, {DP, CP} is labeled as C. Movement of *the* creates the SO {D, CP} whose label is D according to the LA. A similar analysis holds for the RRC, as shown in (28b) (see Tozawa (2017, 2019) for details).

Next, let us discuss the case in which the relative clause head NP forms an idiom chunk with the matrix verb as in (29).

- (29) [... V NP_i [relative clause ... e_i ...]]
 idiom chunk

Given that the nominal part must be base-generated as the complement of the verb, the OMA, rather than the HRA, should be used. Consider (30a, b).

- (30) a. [... V NP_i [relative clause OP_i ... t_i ...]]
 b. [... V NP_i [relative clause ... t_i ...]]

Under the OMA in (30a), the null operator rather than NP is generated in the relative clause. It moves to the left edge of the relative clause and is co-indexed with NP. The relation between NP and the gap in the relative clause is mediated by the null operator. Importantly, NP originates as the complement of the verb, forming an idiom chunk. Meanwhile, under the HRA in (30b), NP does not

originate as the complement of the verb; rather, it is base-generated in the relative clause and then moves to the antecedent position. As V and NP are base-generated in the separate clause, they cannot form an idiom chunk under the HRA. With this in mind, let us turn to IRCs. Our argument is that IRCs can be derived by the OMA or the HRA. We then predict that the IRC head can form an idiom with a matrix verb. This prediction is borne out.

- (31) a. I have a bone to pick with you. (Jespersen 1949: 226)
 b. I pick a bone with you.
- (32) a. You don't have a leg to stand on.
 b. You don't stand on a leg. (den Dikken 2017: 8)

Have a bone to pick with in (31a) is an idiom chunk, meaning “having complaints against someone.” (31b) does not have an idiomatic meaning such as “complaining to someone.” This shows that the nominal part *a bone* forms an idiom chunk with the matrix verb *have*, not the subordinate verb *pick*. The same is true of the idiom chunk in (32a). The idiom *not have a leg to stand on* means “not having a sound justification.” There is no idiomatic reading in (32b). This indicates that the nominal part *a leg* forms an idiom chunk with the matrix verb *have*. The OMA yields a structure in which *a bone* in (31a) is base-generated as the complement of *have*. The IRC has the OMA structure in (33).

- (33) [I [_{VP} have [_{DP} a [_{NP} [_{NP} bone]_i] [_{OPP} OP_i] [_{CP} C [_{TP} to pick *t_i* with you]]]]]]]

The null operator moves to CP to derive the IRC. The IRC adjoins to NP *bone* and then it is co-indexed with the null operator. Next, the D head *a* merges with NP to form DP and this DP merges with the matrix verb *have*, forming an idiom chunk *have a bone to pick with*. In this structure, the nominal part *a bone* originates as the complement of *have*. Therefore, the idiomatic reading is obtained.¹²

5.2. Extraposition

The OMA and the HRA make different predictions concerning whether the

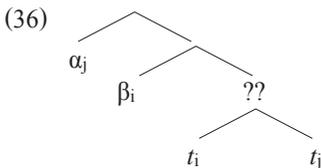
extraposition of relative clauses is allowed. Before we discuss the predictions of the OMA and the HRA, let me introduce the constraint proposed by Narita (2015). This is shown in (34).

- (34) $*\{t, t\}$:
 Syntactic Objects (SOs) whose two members are both “traces” (copies) created by Internal Merge (IM) are ruled out.
 (Narita 2015: 286)

The constraint in (34) states that if two members of a syntactic constituent are traces (copies), the SO is disallowed. Narita argues that the constraint follows from the LA and the principle of Full Interpretation. The principle of Full Interpretation is stated in (35).

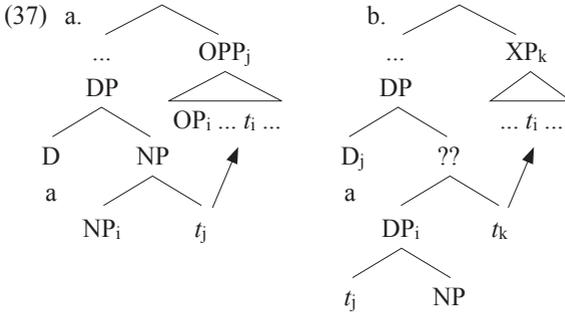
- (35) **Full Interpretation (FI)** (Chomsky 1986 *et seq.*):
 Every element of SEM and PHON must receive an appropriate interpretation.
 (Narita 2015: 286)

If an SO has no label, it cannot be assigned a legitimate interpretation at SEM and PHON, which violates FI. Let us discuss how the constraint in (34) is deduced from the LA and FI. Consider (36).



Suppose that α and β are members of an SO $\{\alpha, \beta\}$, and each of them undergoes Internal Merge. Then, the SO $\{\alpha, \beta\}$ cannot be labeled because α and β are copies, which are invisible to the LA. The unlabeled SO cannot receive an appropriate interpretation at SEM and PHON, which is in violation of FI. Therefore, the SO $\{t, t\}$ is impossible. Thus, the constraint in (34) follows from the LA

and FI. With this constraint in mind, let us consider the extraposition of relative clauses. The OMA and HRA structures have the extraposed structures in (37a, b), respectively.

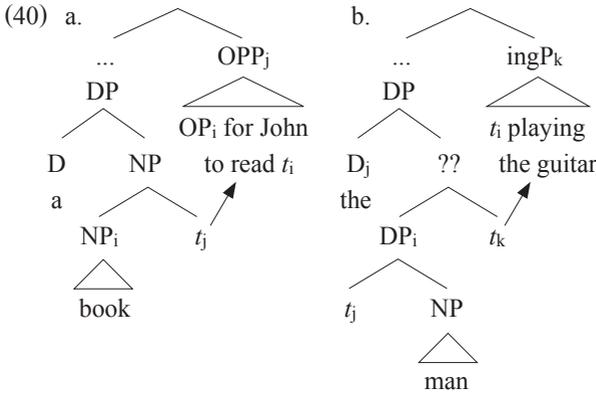


In the OMA structure in (37a), the null operator moves to CP, forming {OP, CP}, which is labeled as OP. Then, it adjoins to NP and is extraposed to a higher position. There is no problem with this derivation. Thus, relative clause extraposition is possible under the OMA. In contrast, the extraposition of the relative clause derived by the HRA violates the constraint in (34) in a broad sense. In (37b), DP moves to the left edge of the relative clause XP and then the D head undergoes further movement. Next, the extraposition of the relative clause XP takes place. Importantly, the extraposition of XP yields the {*t*, *t*} structure in a broad sense. The D head and XP of {DP, XP} are copies, and the minimal search operation cannot find D or X, which causes the label indeterminacy of {DP, XP}.¹³ The unlabeled {DP, XP} violates FI. Therefore, the extraposition of the relative clause derived by the HRA is impossible.¹⁴ In this sense, we can say that the structure in (37b) is a kind of {*t*, *t*}. Our proposal is that the OMA is available for IRCs, while the HRA is available for RRCs. We thus predict that IRCs are extrapposable, while RRCs are not. This prediction is borne out.

- (38) a. I gave Mary a book for John to read yesterday.
 b. I gave Mary a book yesterday for John to read.

- (39) a. I met the man playing the guitar yesterday.
 b. ??I met the man yesterday playing the guitar.

The contrast between (38b) and (39b) shows that the IRC can be extraposed unlike the RRC. The structures in (38b) and (39b) are (40a, b), respectively.



In (40a), the IRC is derived by the OMA: the null operator moves to the left edge to form the SO {OP, CP} whose label is OP. The OPP adjoins to NP and is then extraposed to a higher position. There is no problem with this derivation. Therefore, (38b) is grammatical. In (40b), the RRC is derived using the HRA. DP *the man* moves to ingP, and then the D head *the* undergoes further movement. The SO {D, ingP} formed by the movement of D is labeled as D. Extraposition of ingP then takes place. Note that extraposition yields a kind of {*t*, *t*} structure because the D head and ingP of {DP, ingP} are copies, which are invisible to the LA (also see Tozawa (2019)). {DP, ingP} then cannot be labeled, which violates FI. Therefore, (39b) is ungrammatical.

6. Conclusion

In this paper, we have argued that the OMA and HRA are available for IRCs, whereas only the HRA is available for RRCs. Based on this argument, we

accounted for the syntactic similarities and differences between the IRCs and the RRCs. The analyses and syntactic properties of IRCs and RRCs are summarized in (41).

(41)

	Analysis	CP	Idiom chunk	Extrapolation
IRC	OMA or HRA	✓	✓	✓
RRC	HRA	*	✓	*

IRCs are derived by the OMA or the HRA. They have the CP projection, allow the relative clause head to form an idiom chunk with the verb in the IRC, and are extraposable. Conversely, RRCs are derived by the HRA. They lack the CP projection, allow the relative clause head to form an idiom chunk with the verb in the RRC, and are not extraposable. We demonstrated that the ban on the extraposition of RRCs is attributed to the unavailability of the OMA for RRCs. In this way, the difference in the strategies that IRCs and RRCs use creates a syntactic difference between the IRCs and the RRCs. The question then arises as to why RRCs have only an HRA structure. We suggest that this is because RRCs have no CP projection, leading to the absence of a position for a *wh*-operator to move to. The OMA involves *wh*-movement, which is generally assumed to be movement to CP. However, RRCs have no place (CP) to accommodate the *wh*-operator. Therefore, the OMA is unavailable for RRCs. So far as our analysis is on the right track, it has three theoretical implications. First, it supports Chomsky's (2013, 2015) LA. Second, it supports the availability of right-adjunction contra Kayne (1994), in the sense that relative clauses right-adjoin to NP under the OMA. Third, it upholds the position of Aoun and Li (2003) and Miyamoto (2010) that relative clauses can be derived by the OMA or the HRA.

Notes

1. There is a third approach to finite relative clauses: the Matching Analysis (Chomsky (1965), Hulsey and Sauerland (2006)). The Matching Analysis of Hulsey and Sauerland (2006) is indicated in (i).

(i) $[_{DP} \text{the } [_{NP} [_{NP} CD] [_{CP} [_{NP} \text{€Đ}]_i \text{ that } [_{TP} \text{I bought } t_i \text{ yesterday}]]]]]$

NP *CD* occurs both in the matrix clause and in the relative clause. *CD* moved to CP is elided under identity with matrix *CD*. This is the Matching Analysis. Although strictly speaking it is different from the OMA, it is sometimes treated as equivalent to the OMA. In this study, we regard the Matching Analysis as equivalent to the OMA.

2. Douglas (2016) argues for the Matching Analysis of IRCs. See Douglas (2016) for details.
3. To be precise, Hackl and Nissenbaum (2012) argue that the Matching Analysis and the HRA are available for non-subject IRCs with *should*-readings. However, Hackl and Nissenbaum leave it open whether the Matching Analysis is involved in deletion or null operator movement. For the sake of clarity of discussion, we regard Hackl and Nissenbaum's Matching Analysis as the OMA.
4. *Could* in (13b) is an epistemic modal.
5. Given that in the early minimalist framework, the null operator occupies the specifier position (the XP position), it is natural to assume that the null operator is an XP element. Therefore, it may be problematic to treat the null operator as a lexical head. We leave this problem for future research.
6. Chomsky (2019a, b) is skeptical about the DP hypothesis, suggesting that determiners are adjuncts. If we adopt Chomsky's suggestion, the determiner *a* in (19b) adjoins to NP, as illustrated in (i).

(i) $[_{NP} a [_{NP} [_{NP} \text{letter}] [_{OPP} OP_i [_{CP} C [_{TP} \text{to write } t_i]]]]]$

In the case of the HRA in (19c), we suggest that NP rather than DP moves to IRC CP, N undergoes further movement, and then the determiner adjoins to NP, as shown in (ii).

(ii) $[_{NP} a [_{NP} [_{N} \text{letter}]_j [_{CP} [_{NP} t_j]_i [_{TP} \text{to write } t_i]]]]]$

We leave the question open of whether the analyses in (i) and (ii) are superior to those in (19b) and (19c).

7. We do not treat subject infinitival relative clauses such as (i).

(i) I'm looking for someone to help me with my work.

The relative clause head *someone* is the subject of the IRC. Subject IRCs are different from non-subject IRCs in that they can have a non-modal interpretation. Furthermore, when the relative clause head is the matrix subject, the sentence including the subject IRC is worse than that including the non-subject IRC.

(ii) a. A man to fix the sink is at the front door.

b. Something for you to fix is at the front door.

(cf. Chomsky and Lasnik 1977: 464)

According to Chomsky and Lasnik (1977), (iia) is less acceptable than (iib). This shows that subject IRCs have a different property from non-subject IRCs. In fact, Bhatt (1999) argues that subject IRCs lack CP, while non-subject IRCs have CP. See Bhatt (1999) for details.

8. One might wonder whether minimal search locates both N and *-ing*, leading to label indeterminacy. Minimal search may locate *-ing* first because *-ing* is less embedded than N in {DP, ingP}. Therefore, {DP, *-ing*P} may be labeled as *-ing*. I thank an anonymous reviewer for bringing this possibility to my attention.
9. We use the term “projection” for convenience of exposition. Projection, which is a linguistic apparatus, is eliminated from the theory of grammar, and the syntactic label is determined by minimal search. See Section 2 for details.
10. If the overt *wh*-element in the IRC does not pied-pipe P, the sentence is ungrammatical.
 - (i) a. premises [[from which]_i to draw interesting conclusions t_i]
 - b. *premises [[which]_i to draw interesting conclusions from t_i]

(cf. McCawley 1998: 439)

(ib) shows that IRCs disallow the relative operator, similar to RRCs. We argue that the ungrammaticality of (ib) is due to the label indeterminacy. The SO {DP, CP} created by Internal Merge of *which* with infinitival CP is the XP-YP structure whose label cannot be determined. Therefore (ib) is ungrammatical (also see Tozawa (2018)). However, we incorrectly predict that (ia) is also ungrammatical because {PP, CP} is the XP-YP structure. We leave this problem for future research.

11. The *-ing* clause is the RRC rather than the gerundive clause.
12. An anonymous reviewer suggests the possibility that *a bone* in (31a) originates as the complement of *pick* as well as *have*, which supports the Matching Analysis. In this study, we consider the Matching Analysis identical to the OMA and thus do not discuss whether the complement of *pick* is the null operator or *a bone*. However, as the anonymous reviewer points out, the equivalence of the Matching Analysis to the OMA may be controversial. Consider (i).

- (i) John paid the same heed last year that Mary paid.

(Henderson 2007: 215)

(i) shows that the idiomatic interpretation of *pay heed* is available both in the matrix clause and in the relative clause. Given that extraposed relative clauses are derived by the OMA, as discussed in Section 5.2, (i) supports the Matching Analysis rather than the OMA. I thank the anonymous reviewer for bringing this issue to my attention.

13. An anonymous reviewer wonders whether {DP, ingP} in (37b) is labeled as NP because minimal search can locate N, which is visible to labeling. N may be too weak to serve as a label, similar to T, so that {DP, ingP} cannot be labeled as N. I thank the anonymous reviewer for suggesting this possibility.
14. One might wonder whether extraposition of the relative clause is possible if the D head does not undergo movement. Consider the derivation in (i).
- (i) a. [DP_i [XP ... t_i ...]]
 b. [... [DP DP_i t_j] ... [XP ... t_i ...]_j]

In (ia), DP moves to the relative clause XP and the D head does not undergo further movement. In (ib), XP is extraposed to a higher position. In this derivation, {DP, XP} is labeled as D because XP is a copy. Therefore, XP should be able to be extraposed under the HRA. We suggest that movement of the D head is obligatory. We leave open the question of why the D head must undergo movement.

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