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The semantics of Rudin constructions in Romanian*

Ivano Caponigro[1] and Anamaria Fălăuș[2]

[1] University of California San Diego, U.S.A
ivano@ucsd.edu
[2] Centre National de la Recherche Scientifique-Laboratoire de Linguistique de Nantes, France
anamaria.falaus@cnrs.fr

Abstract

We broaden the empirical and formal landscape of *wh*-constructions by describing and analyzing an understudied non-interrogative *wh*-construction requiring multiple *wh*-expressions, to which we refer as the 'Rudin construction'. We argue that, unlike other multiple *wh*-constructions studied to date, Rudin constructions are biclausal and should be semantically analyzed as establishing identity between the extensions of two relations.

1 Introducing the Rudin construction

Four Romanian friends decide to have a potluck picnic on Sunday. Unfortunately, the friends haven't shared their food restrictions or preferences ahead. Once they get together, they find out that none of them likes or can eat any of the food the others prepared. So, each of them ends up eating only their own food. The not-so successful end of this potluck story can be precisely and concisely conveyed in Romanian by means of the sentence in (1).

(1) La picnicul de duminică _ a mâncat _ [cine$_1$ ce mâncare$_2$ _$_1$ a pregătit _$_2$].
at picnic-the of Sunday has eaten who what food has prepared
'Each person ate at the picnic on Sunday what (s)he prepared, and nothing else.'

The sentence in (1) looks like it is made of two fully tensed clauses, each with a fully inflected transitive verb ('eat', 'prepare'). Both predicates are obligatorily missing their subject and object arguments—highlighted with underscores. If either argument is realized in either clause, the whole sentence becomes fully unacceptable. The bracketed clause is introduced by two (underlined) *wh*-expressions (i.e., *wh*-words or *wh*-phrases) that are linked to its missing subject and object—highlighted with the shared subscripts "1" and "2". The other clause doesn't have any overt clause-internal marker correlating with its missing subject or object—highlighted with plain underscores without subscripts. The whole sentence is interpreted as asserting that each eater ate at the picnic on Sunday all and only the food that (s)he prepared. In other words, the sentence asserts the identity between the set of ordered pairs of ⟨eater, eaten-food⟩ associated with the first clause and the set of ordered pairs ⟨food-preparer, prepared-food⟩ associated with the second clause.

The sentence in (1) is an example of a typologically rare construction that, on the other hand, is extremely productive in Romanian. Other examples are given in (2) with a missing object (a locative object in (2b)) and a missing adjunct in each example, as well as in (3) with three missing constituents and corresponding *wh*-expressions.

(2) a. Fac [ce cum îmi place].
do.1SG what how me.DAT likes
'I do whatever I like however I like it.'

b. Mergi [unde când vrei]!
go.IMP.2SG where when want.2SG
'Go wherever you want whenever you want!'

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(3) Gustă [cine ce când termină de preparat].
tastes who what when finishes of prepared
'Everyone tastes what they are done preparing when they are done preparing it.'

We call the construction in (1)–(3) a "Rudin construction" since Catherine Rudin was the first scholar to mention and describe it, to the best of our knowledge (Rudin 1986, 2007, 2008). It has been largely neglected since with the exception of the brief discussion in Caponigro and Fălăuş (2020) and the semantic analysis in Nicolae (2020). Rudin constructions seem to be attested in other Balkan languages like Bulgarian or Macedonian, but at this stage we focus on Romanian, leaving it open whether the constructions in those languages are identical. In this paper, we propose a compositional semantic analysis that captures the semantic properties of Rudin constructions like (1)–(3) and argue that it is superior to the one in Nicolae (2020).

2 Semantic analysis of the Rudin construction

A Rudin construction is always a fully biclausal construction, as schematized in (4).

(4) $[_{\text{Clause1}} \cdots \__1 \cdots \__2 \cdots \__n \cdots \; [_{\text{Clause2}} \; \textbf{wh-}_1 \; \textbf{wh-}_2 \; \textbf{wh-}_n \cdots \__1 \cdots \__2 \cdots \__n \cdots]]$, $n \geq 0$

Clause_1 of a Rudin construction always occurs first (left-most) and behaves like the main clause, determining the semantic and pragmatic features of the whole Rudin construction. If Clause_1 is declarative, then the whole Rudin construction is declarative, as in (1); if Clause_1 is interrogative, as in (5), or imperative (2b), then the whole Rudin construction will be interrogative or imperative, respectively. Clause_1 allows for left-dislocated topicalized constituents or moved *wh*-constituents—the latter case is illustrated in (5).

(5) A: **Unde** a mâncat (duminică) [cine ce mâncare a pregătit]? B: La picnic.
where has eaten Sunday who what food has prepared at picnic
'Where did (on Sunday) everyone eat the food they prepared?' 'At the picnic.'

Clause_2 of a Rudin construction always occurs to the right edge of Clause_1. We tentatively assume that Clause_2 is an embedded *wh*-clause (a CP) that is adjoined somewhere in the left periphery of Clause_1, the main clause (we leave further syntactic investigation to future work). Clause_1 and Clause_2 are missing the same number and kinds of constituents (arguments or adjuncts)—at least two. While Clause_1 leaves the missing constituents unmarked, Clause_2 is obligatorily introduced by a series of fronted *wh*-expressions matching the missing arguments or adjuncts. Clause_2 can make use of all the *wh*-expressions attested in interrogative clauses and exhibits similar ordering constraints. The whole Rudin construction can be embedded within a larger sentence, as shown in (6).

(6) Mă întreb dacă [la picnicul de duminică a mâncat cine ce a pregătit].
me wonder.1SG if at picnic-the of Sunday has eaten who what has prepared
'I wonder whether at the picnic on Sunday everyone ate what they prepared.'

In this paper, we focus on developing a semantic analysis for Rudin constructions. In particular, we argue that a Rudin construction denotes identity between the extensions at the world of evaluation w_0 of two $2{+}n$-place relations ($n \geq 0$) ranging over ordered $2{+}n$-tuples—one relation being denoted by the relevant portion of Clause_1[1], the other being denoted by the whole Clause_2,

[1]The "relevant portion" of Clause_1 is the part of the clause going all the way up to the node right below the node to which Clause_2 adjoins. Henceforth *Clause*$_1$ is used as a shortcut for that portion of Clause_1.

as schematized in (7). The "2+n" requirement captures the fact that a Rudin construction always has at least two missing constituents.

(7) $[\![\lambda x_1 \lambda x_2 \ldots \lambda x_n \textbf{Clause}_1(x_1, x_2 \ldots x_n)]\!]^{w0} = [\![\lambda x_1 \lambda x_2 \ldots \lambda x_n \textbf{Clause}_2(x_1, x_2 \ldots x_n)]\!]^{w0}$

We propose that the two 2+n-place relations in (7) are derived by means of the same basic syntax/semantics mechanisms: the operator-variable relation that has been assumed for several constructions that display overt or covert operator movement. Clause_2 is more "transparent" in this respect: the overt, fronted *wh*-expressions in Spec,CP signal the missing constituents within the lower TP and license *wh*-traces/variables in their base-generated position. Each moved *wh*-constituent triggers (type-flexible) λ-abstraction over the variable it licenses right before combining with its sister (i.e., the portion of Clause_2 the given *wh*-expression c-commands). Therefore, if the portion of Clause_2 that is c-commanded by a given *wh*-expression denotes a semantic object of type m and the *wh*-variable is of type r, the resulting constituent after λ-abstraction (i.e., the sister of the *wh*-expression) denotes a semantic object of type $\langle rm \rangle$. We assume flexible semantic types for *wh*-expressions as well: if its sister is of type $\langle rm \rangle$, then the *wh*-expression will be of type $\langle rm, rm \rangle$. The *wh*-expression semantically acts as a restrictor: it applies to an object of type $\langle rm \rangle$ to return an object of the same type with further semantic restrictions like 'human' if the *wh*-expression is 'who', inanimate if it is 'what', etc. For instance, Clause_2 in (1) ends up denoting a 2-place relation in (8e) by first saturating the 2-place predicate 'prepare' with the *wh*-traces/variables in object and subject positions (8a) and then abstracting over each of those *wh*-variables, one at a time (8b,d), right before each of them combines with the corresponding *wh*-expression (8c,e).

(8) a. $[\ \__1$ a pregătit $\__2\ ] \rightsquigarrow \text{prepared}(x_1, x_2)_t$
b. $[\lambda_2[\ \__1$ a pregătit $\__2\ ]\ ] \rightsquigarrow \lambda x_2 \text{prepared}(x_1, x_2)_{\langle et \rangle}$
c. $[\underline{\text{ce mâncare}_2}\ \lambda_2[\ \__1$ a pregătit $\__2\ ]\ ] \rightsquigarrow \lambda x_2[\text{prepared}(x_1, x_2) \wedge \text{food}(x_2)]_{\langle et \rangle}$
d. $[\lambda_1[\underline{\text{ce mâncare}_2}\ \lambda_2[\ \__1$ a pregătit $\__2\ ]]] \rightsquigarrow \lambda x_1 \lambda x_2[\text{prepared}(x_1, x_2) \wedge \text{food}(x_2)]_{\langle e,et \rangle}$
e. $[\underline{\text{cine}_1}\ \lambda_1[\underline{\text{ce mâncare}_2}\ \lambda_2[\ \__1$ a pregătit $\__2\ ]]] \rightsquigarrow \lambda x_1 \lambda x_2[\text{prepared}(x_1, x_2) \wedge \text{food}(x_2) \wedge \text{human}(x_1)]_{\langle e,et \rangle}$

We envision that the same derivational mechanism is at play to derive the denotation of Clause_1 as a 2+n-place relation. The only difference is that we assume phonologically null operators (Op) as silent counterparts of *wh*-expressions, since the missing constituents of Clause_1 are not marked by any *wh*-expressions or any other marker. Silent operators too move to the left periphery, license traces/variables in their base-generated positions and then bind those traces/variables via λ-abstraction. Notice that something along these lines is usually assumed to handle relative clauses with no overt relative pronoun or relative markers, like *the food they prepared*, *the way he laughs*, or *the day she left* in English. For instance, the semantic derivation of Clause_1 in (1) would proceed as in (9a–e), which parallels the derivation of Clause_2 in (8a–e). The only main difference is that silent operators do not carry any further semantic restrictions, unlike overt *wh*-expressions, and, therefore, semantically behave like identity functions. In other words, they are semantically inert and their main function is to license *wh*-variables and trigger λ-abstraction (this is why the logical translations in (9b,c) and (9d,e) are identical).

(9) a. $[\ \__1$ a mâncat $\__2\ ] \rightsquigarrow \text{ate}(x_1, x_2)_t$
b. $[\lambda_2[\ \__1$ a mâncat $\__2\ ]] \rightsquigarrow \lambda x_2 \text{ate}(x_1, x_2)_{\langle et \rangle}$
c. $[\textbf{Op}_2\ \lambda_2[\ \__1$ a mâncat $\__2\ ]] \rightsquigarrow \lambda x_2 \text{ate}(x_1, x_2)_{\langle et \rangle}$
d. $[\lambda_1[\textbf{Op}_2\ \lambda_2[\ \__1$ a mâncat $\__2\ ]]] \rightsquigarrow \lambda x_1 \lambda x_2 \text{ate}(x_1, x_2)_{\langle e,et \rangle}$
e. $[\textbf{Op}_1\ \lambda_1[\textbf{Op}_2\ \lambda_2[\ \__1$ a mâncat $\__2\ ]]] \rightsquigarrow \lambda x_1 \lambda x_2 \text{ate}(x_1, x_2)_{\langle e,et \rangle}$

When Clause_2 adjoins to Clause_1, we propose that their denotations at the world of evaluation are identified by means of the new operator in (10), which we label 'Rudin operator' (O_{RUDIN}). The Rudin operator takes the $2{+}n$ relation R of type m denoted by Clause_2 as its first argument and the $2{+}n$ relation Q of the same type m denoted by Clause_1 as its second argument to return the truth if those relations are extensionally identical at the world of evaluation.

(10) *Rudin Operator*: $\lambda \text{R}_{2+n} \lambda \text{Q}_{2+n} [\text{R}_m = \text{Q}_m]_{\langle m, mt \rangle}$

The Rudin operator contains a high degree of flexibility, as the direct reflex of the variable number and nature of missing constituents within a Rudin construction. This operator is flexible as far as its semantic type is concerned, as highlighted by the unspecified type m inside the Rudin operator semantic type $\langle m, mt \rangle$ in (10). This flexibility follows from the variable n-ary of the relations the Rudin operator identifies: n-ary of two or more, as long as identical between the two relations. This captures the fact that a Rudin construction can have two or more missing constituents, as long as the number of missing constituents is the same between Clause_1 and Clause_2. The flexibility of the semantic type of the Rudin operator also depends on the variable nature (i.e., semantic type) of the arguments of its relations, as long as they are the same across the two relations. This reflects the fact that the semantic type of a missing constituent that is marked by the *wh*-expression 'who' may not be the same as the missing constituent that is signaled by the *wh*-expression 'where' or 'when'.[2] Finally, the Rudin operator makes use of a flexible relation of identity, which applies to objects of variable semantic type. Syntactically, the Rudin operator occupies the head of the highest functional projection of Clause_2, as shown in (11).

(11) $[_{\text{CP-Clause1}} \ldots [_{\text{CP-Clause2}} \ \mathbf{O_{RUDIN}} \ [_{\text{CP-Clause2}} \ldots]]]$

Let's exemplify how the Rudin operator works by returning to the semantic derivation of (1). First, we apply the Rudin operator as defined in (10) to Clause_2 in (1), whose logical translation was given in (8e). This is shown in (12). Then, we apply (12) to Clause_1, whose logical translation was given in (9e). The final result is the identity in (13).

(12) $[\mathbf{O_{RUDIN}} \ [\underline{\text{cine}}_1 \ \lambda_1 [\underline{\text{ce mâncare}}_2 \ \lambda_2 [\__1 \text{ a pregătit } \__2 \ ]]]] \rightsquigarrow$
$\lambda \text{R} \lambda \text{Q} [\text{R}_{\langle e,et \rangle} = \text{Q}_{\langle e,et \rangle}] (\lambda \text{x}_1 \lambda \text{x}_2 [\text{prepared}(\text{x}_1,\text{x}_2) \wedge \text{food}(\text{x}_2) \wedge \text{human}(\text{x}_1)])$
$\lambda \text{Q} [\lambda \text{x}_1 \lambda \text{x}_2 [\text{prepared}(\text{x}_1,\text{x}_2) \wedge \text{food}(\text{x}_2) \wedge \text{human}(\text{x}_1)] = \text{Q}]$ (*by λ-reduction*)

(13) $[[\underline{\text{Op}}_1 \ \lambda_1 [\underline{\text{Op}}_2 \ \lambda_2 [\__1 \text{ a mâncat } \__2]]] \ [\mathbf{O_{RUDIN}} [\underline{\text{cine}}_1 \ \lambda_1 [\underline{\text{ce mâncare}}_2 \ \lambda_2 [\__1 \text{ a pregătit } \__2]]]]]$
$\rightsquigarrow \lambda \text{Q} [\lambda \text{x}_1 \lambda \text{x}_2 [\text{prepared}(\text{x}_1,\text{x}_2) \wedge \text{food}(\text{x}_2) \wedge \text{human}(\text{x}_1)] = \text{Q}] (\lambda \text{x}_1 \lambda \text{x}_2 \text{ate}(\text{x}_1,\text{x}_2))$
$\lambda \text{x}_1 \lambda \text{x}_2 [\text{prepared}(\text{x}_1,\text{x}_2) \wedge \text{food}(\text{x}_2) \wedge \text{human}(\text{x}_1)] = \lambda \text{x}_1 \lambda \text{x}_2 \text{ate}(\text{x}_1,\text{x}_2)$ (*by λ-reduction*)

The Rudin operator also provides an answer to the question of what ensures the correct number and nature of the missing constituents in Clause_1. (Remember that the missing constituents in Clause_1 are not marked, unlike those in Clause_2.) Let's assume that the grammar is free to generate clauses with any number and any kind of missing arguments and/or adjuncts without any overt marking, as in Clause_1. The Rudin operator requires its two clausal arguments to be of the same semantic type: if Clause_1 had a different number or type of missing constituents than Clause_2, then the two clauses would not have the same semantic type, the Rudin operator would fail to apply, and the semantic derivation of the whole Rudin construction would crash.

Another welcome consequence of our analysis is that it provides an account for the "impression" that each *wh*-expression in a Rudin construction is "connected" to both Clause_1 and Clause_2—a feature that sets the Rudin construction apart from other kinds of multiple

[2] On the identity of semantic types among *wh*-expressions, see Caponigro and Pearl (2008, 2009).

wh-clauses in Romanian (see Caponigro and Fălăuş 2020). According to our analysis, the *wh*-expressions per se are part of Clause_2 only and license the missing constituents only in Clause_2. Still, as discussed above, *wh*-expressions affect the semantic type of Clause_2, which in turn affects the semantic type of the Rudin operator, which in turn requires Clause_1 to have the same semantic type and, therefore, the same number and kinds of missing constituents as Clause_2.

A further welcome consequence of our account is that it captures the intuition that the interpretation of *wh*-expressions in a Rudin construction is akin to a universal quantifier like 'every one' or 'each one' or a free choice item like 'anyone' or 'whoever', as highlighted in the English translations of our examples of the Rudin construction. This intuition is strengthened by native speakers' willingness to paraphrase a Rudin construction with sentences containing overt universal quantifiers or free choice items as in (14).

(14) Mănâncă {**fiecare**/ **oricine**} **(ori)ce** aduce.
eats everyone/ anyone what(ever) brings
'Everyone eats what(ever) they bring.'

Our analysis accounts for this intuition without assuming any universal quantifier, but by means of the identity between the extensions of two relations that is imposed by the Rudin operator.

Last, our analysis crucially relies on flexible λ-abstraction and identity between extensions of variable n–ary relations. These are the same tools that are used in the "classical" semantic analysis of *wh*-interrogative clauses as partitions in Groenendijk and Stokhof (1982).

3 Comparison with a previous account

The Rudin construction has received little attention in general, let alone within formal semantics. We are aware of only one other semantic analysis—the one in Nicolae (2020).[3] In this section, we briefly summarize it and discuss additional facts in favor of our proposal.

Nicolae (2020) discusses Rudin constructions with two missing arguments (suggesting that missing adjuncts may be treated as arguments as well). Within this restricted empirical landscape, she analyzes both Clause_1 and Clause_2 as denoting sets of functions of type $\langle ee \rangle$, although their semantic compositions are partially different. The denotation of Clause_1 is derived by turning the lexical entry of its transitive predicate from a semantic object of type $\langle e, et \rangle$ to one of type $\langle ee, t \rangle$ by means of the type-shifter TSH. For instance, Clause_1 in (1) would be initially analyzed as in (15a), to which TSH would apply resulting in (15b).

(15) a. $\text{ate} \rightsquigarrow \lambda y_e \lambda x_e \text{ate}(x,y)$ b. $\text{TSH}(\text{ate}) \rightsquigarrow \lambda f_{\langle ee \rangle} \forall x[\text{ate}(x,f(x))]$

The semantic derivation of Clause_2, instead, builds on the analysis of multiple correlative clauses in Dayal (1996), and the treatment of functional multiple *wh*-interrogative clauses in Abels and Dayal (2017) and Xiang (2021). Clause_2 denotes a set of functions of type $\langle ee \rangle$, which for Clause_2 in (1) amounts to the set of functions from people to food they prepared, as in (16).

(16) $[\text{who what food prepared}] \rightsquigarrow \lambda f_{\langle ee \rangle}[\text{Range}(f)=\text{food} \wedge \forall x[\text{human}(x) \rightarrow \text{prepared}(x,f(x))]]$

The semantic contributions of the two clauses are combined by means of the 2-place operator THE, defined as in (17).

[3] Nicolae (2020) follows Rudin (1986) in calling what we label Rudin constructions "multiple *wh* relative clauses". We have shown elsewhere that Romanian allows for true free relative clauses with multiple *wh*-expressions, which exhibit clear differences with Rudin constructions (Caponigro and Fălăuş 2020).

(17) THE $\rightsquigarrow \lambda F_{\langle ee,t\rangle}\lambda G_{\langle ee,t\rangle}\exists f_{\langle ee\rangle}[(f{=}\iota g \text{ s.t. } F(g)) \wedge G(f)]$

THE first applies to the denotation of Clause$_2$ in (16) and the resulting predicate then applies to the denotation of Clause$_1$ in (15b). The whole sentence in (1) receives the logical translation in (18), which is true iff there is a unique function from individuals to the food they prepared and everyone ate the thing they prepared.

(18) [THE(who what food prepared)](ate) $\rightsquigarrow$
$\exists f[(f{=}\iota g \text{ s.t. } \text{Range}(g){=}\text{food} \wedge \forall x[\text{human}(x) \rightarrow \text{prepared}(x,g(x))]) \wedge \forall x[\text{ate}(x,f(x))]]$

A first crucial difference between our analysis and Nicolae's has to do with the truth conditions of Rudin constructions, as also noted by one of our reviewers. Specifically, the account in Nicolae (2020) requires there to be only one function $\langle ee\rangle$ associated with Clause$_2$, while no such restriction applies to the functions associated with Clause$_1$. In the case of (1), this implies that there's only one mapping between people and the food they prepared and there can be more than one mapping between people and the food they ate. One of these mappings would be identical to the one associated with Clause$_1$, that is, it would map people with the food they prepared and ate, but there could be another mapping according to which people also ate food other than the one they prepared. This is contrary to the intuitions reported by our consultants for the Rudin construction in (1), whereby each person eats only the things (s)he prepared. Our semantic analysis, which requires identity between the set of ⟨eater, eaten-food⟩ pairs and the set of ⟨food-preparer, prepared-food⟩ pairs, delivers the correct interpretation.

Another significant difference between our analysis and Nicolae's has to do with the number of missing constituents in Rudin constructions. As already mentioned, Nicolae (2020) is specifically couched for Rudin constructions with only two missing constituents, while there are Rudin constructions with three (or more), as shown in (3). The crucial components of our analysis–flexible λ-abstraction and flexible Rudin operator–have been designed with this empirical fact in mind. Nicolae's analysis, instead, crucially builds on a functional dependency between the higher and the lower *wh*-constituents; it's unclear how a third *wh*-constituent would be handled. Also, both the type-shifter TSH and the 2-place operator THE are inherently defined for two variables rather than three (or more). It remains to be seen how to broaden these formal tools so as to handle Rudin constructions with three (or more) missing constituents.

4 Conclusions and outstanding issues

We have shown that Romanian has a biclausal non-interrogative multiple *wh*-construction—the Rudin construction—and have argued that it should be semantically analyzed as establishing identity between the extension of two relations. The relations involved in Rudin constructions are always $2{+}n$-place relations with $n \geq 0$. In other words, no Rudin construction is allowed with just one missing constituent for each clause (evidence supporting this generalization needs to be omitted here for reasons of space). The outstanding issue that we leave for future investigation is why Rudin constructions exhibit this restriction. No component of our analysis predicts that. The analysis in Nicolae (2020) doesn't provide a principled explanation of this restriction either. In fact, it is expressly based on analyses of correlative and interrogative clauses—constructions that easily allow for only one *wh*-expression/missing constituent.

We have focused on Romanian, but Rudin constructions seem to be attested in other languages as well (Rudin 1986, 2007, 2008). A crosslinguistic investigation may provide a better grasp of generalizations and properties concerning Rudin constructions and further develop their syntactic and semantic analyses. We hope to have started contributing to this enterprise.

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