

Representing scales: Degree result clauses and emphatic negative polarity items in Romanian

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Scales play an important role in recent research in formal semantics and pragmatics. So far, however, there has been no attempt to integrate them into HPSG. In this paper, we discuss two phenomena for which a scalar analysis is very natural: high degree readings of result clause constructions (RCX) and emphatic negative polarity items (E-NPI). We will provide a scalar extension of a standard account of degree RCXs to capture high degree readings, and propose a constraint-based version of a pragmatic, scalar approach to E-NPIs. We can, then, derive that high degree readings are common with E-NPIs inside RCXs in Romanian, as in (1). We will formulate our analysis in *Lexical Resource Semantics*.

- (1) După ce am adormit, s-a lăsat o ceață densă,
[de #(nu) se vedea om cu om]. (CoRoLa)
Intended: ‘As I fell asleep, the fog scudded
down, so thick [you couldn’t see your hand in
front of your face].’

First- and second-order result clause constructions
Hoeksema & Napoli (to appear) define *first-* and *second-order constructions* starting from the syntactic patterns of the *resultative predicates*, which are typical in languages such as English. We will use a similar distinction for a different syntactic pattern – finite *result clauses* (RCLs). *Result clause constructions* (RCXs) express a primary predication in the main clause and a secondary predication in the result clause. *First-order RCXs* refer to cases in which the RCL conveys a result state of the primary predicate; *second-order RCXs* represent those cases when the RCL expresses a high degree of intensity of the primary predicate, the result interpretation being entirely replaced by an idiomatic, intensification reading.

In this paper, we will focus on the RCXs that have a high degree interpretation, including those first-order RCXs that, apart from the degree reading, also keep the notion of result.

In Romanian, RCLs can be introduced with complementizers such as *încât* (typically), *că*, or *de* (see GBLR, Pană-Dindelegan 2010, 583); the latter seems to be restricted to RCLs that are associated with an emphatic result: in (2), a strongly favorable consequence of the quality of being elegant (i.e., being *admired*) is contrasted with a neutral consequence, where Ion is no more than *noticed*:

- (2) Ion se îmbracă așa de elegant [de lumea
Ion REFL dresses so elegantly that people
îl admiră]/[#de lumea îl observă].
him admire/that people him notice
‘Ion dresses so elegantly that people admire

him/that people (no more than) notice him.’

Conventionalized finite RCLs, many originating from RCLs hosting regular word combinations associated with an extreme outcome, seem to represent a productive pattern for expressions that have been lexicalized into high-degree modifiers in Romanian (i.e., our second-order RCXs). Moreover, these conventionalized expressions normally occur with *de* and reject interchangeability with *încât* – the typical connector for the nonconventionalized, regular RCLs – see (3):

- (3) (*râd*) *de* (/#*încât*) *mor/mă sparg/mă stric* (lit.: (I laugh) that I die/break into pieces/break down);
(*bucuros*) *de* (/#*încât*) *nu se poate* (lit.: (happy) that it cannot be);
(*minte*) *de* (/#*încât*) *îngeheață apele* (lit.: (s/he lies) that waters are freezing), etc.

To summarize, we made the following observations: RCXs can have a high degree interpretation (**OBS1**); *de*-RCXs require an emphatic statement inside the RCL (**OBS2**); There are lexicalized RCLs that *only* have an intensification reading (**OBS3**).

Emphatic negative polarity items used as intensifiers A prominently-studied case of emphatic statements (Krifka 1995, Eckardt 2005, Chierchia 2006, and others) is related to E-NPIs – expressions that are excluded from positive environments, see the infelicity marking “#” in (1). Many E-NPIs are also *minimizers* – typically denoting minimal entities, quantities, or activities, such as *see one’s hand in front of one’s face*, or *say a word*. The observation is that, if an expression denoting something minimal is negated – in the examples above, negating some minimum pragmatic threshold that for the speaker counts as an event of *seeing/speaking* – this can lead to an emphatic utterance (Krifka, 1995; Eckardt, 2005).

It is no surprise that minimizers are very naturally employed for obtaining high degree readings when embedded in RCLs, as shown in a sentence such as (4). The minimizer emphatically indicates an extremely low degree of visibility, with consequences on (what we can infer as) the extreme intensity of the darkness:

- (4) It was so dark [that I couldn’t see my hand in front of my face].

In our study of Romanian E-NPIs, we have encountered three types, each illustrated with only one example in this abstract, that we can distinguish on the basis of four tests (**T1–T4**, examples (15)–(21) on the last page).

T1: Can we change the RCX into a coordination without changing the meaning of the expression?

As shown in (15), this is the case for E-NPI1 and E-NPI2. For E-NPI3s, however, only the literal reading is avail-

able in the coordination – see (16b) – i.e., **T1** distinguishes between the third type and the first two types of E-NPIs.

According to **T1**, E-NPI1 and E-NPI2 are felicitous since they have an idiomatic, quantificational meaning (i.e., *there is no visibility at all*), which remains unchanged if they are not used in an RCX. To explain, minimizer expressions such as *a se vedea la un pas* and *a se vedea om cu om* clearly have distinct literal meanings – one expressing visibility within the distance of a step, the other visibility to the nearest person in someone’s immediate range of sight. Used as NPIs, however, both assert the *absence of visibility*. By contrast, in the case of E-NPI3, if the sentence hosting it is considered in isolation, the expression suffers a change in meaning – only the literal reading becomes available – which also explains the infelicity of the coordinated sentences that are expected to allow the inference of a result relation. E-NPI3 does not pass **T1**, which proves that the meaning that the expression in the RCl would have in isolation – see (16b) – does not contribute to the high degree meaning, *extremely hungry*, of the RCX. Moreover, this also shows that, in (16a), the high degree reading is not obtained on the basis of the literal interpretation of *nu te văd* (lit.: I cannot see you), in case its collocator in the RCX is *foame* ‘hunger’ (i.e., the literal interpretation of *not seeing somebody* is not felt as a natural consequence of *being hungry*).

In **T1**, the RCX is changed into a coordination, and a result relation can be inferred in all the examples. In **T2**, we will look at cases in which no such inferable relation is possible. Since E-NPI3 is already excluded by **T1**, we will only apply **T2** to E-NPI1 and E-NPI2.

T2: Can the expression be used felicitously if the context does not permit the inference of a result relation?

As shown in (17), E-NPI1 passes **T2**, whereas E-NPI2 cannot be used felicitously in the absence of a salient result relation in the discourse.

The following test looks at the distribution of the possible complementizers of the RCl that occur in high degree result constructions:

T3: Is variation with respect to the RCl complementizer possible without a change of meaning in the expression from the result clause?

In (18), E-NPI1 and E-NPI2 allow for both *de* and *încât*, while the meaning of the RCl remains unchanged (i.e., *there is no visibility at all*); by contrast, E-NPI3 requires the presence of *de*, see (19). The use of *încât* triggers a change in meaning: the expression in the RCl can only be interpreted literally.

T4 is intended to clarify what is the meaning contribution of the RCl to the overall RCX:

T4: Does the result clause construction entail the sentence in the result clause?

The fact that the RCX with the interpretation of ‘extremely hungry’ in (21) does not entail the meaning of the sentence in the RCl proves that the sole meaning contribution of the expression to the RCX is *intensification* i.e., the RCl asserts high degree rather than its result reading. This contrasts with (20), where the result interpretation (i.e., *there is no visibility at all*) is also present.

The results of our tests are summarized in Table 1. Based on our tests, we can identify three types of E-NPIs that can occur in RCXs with high degree readings: 1. NPIs that are only occasionally used in result clauses and act as intensifiers (the result interpretation is also present) (E-NPI1); 2. NPIs that are bound to contexts with a result reading; they encode a high degree reading, while also keeping the notion of result (E-NPI2); 3. NPIs that express nothing but intensification, being lexicalized into high-degree modifiers (E-NPI3). The first two classes of E-NPIs occur in first-order RCXs, the third is restricted to second-order RCXs.

Having presented the core data, we will now sketch the general framework that we will use in our analysis.

Framework While RCXs are often looked at as modifiers of gradable verbs (Beavers, 2012), we will restrict our analysis to RCl modifying adjectives. Fleischhauer (2016, 2018) provides an excellent discussion of the various readings that occur in verbal gradation and links this explicitly to the gradation of adjectives. For this reason, we hope that there will be a natural extension of our analysis to verbs, provided a mechanism that allows us to extrapolate an appropriate degree (or “extent”) of a verb. We will adapt a degree-semantic analysis of adjectives along the lines of Meier (2003) and Kennedy & McNally (2005a,b). Consequently, an adjective such as *dark* is a two-place predicate, relating an individual to its degree/extent of darkness.

According to Meier (2001, 2003), a result clause is semantically analyzed in terms of degree comparison. Sentence (5) is true iff the maximal degree of the room’s darkness is at least as high as the minimal degree d that is necessary such that if it is dark to degree d , Alex cannot see anything. This is expressed in the logical form below the example. Meier (2003) provides extensive motivation for adding a modal operator, \square or \diamond , in the interpretation of RCl.

(5) The room was so dark that Alex didn’t see anything.

$\text{Max}(\{d \mid \text{dark}(d, \text{the-room})\})$
 $\geq \text{Min}(\{d \mid \text{dark}(d, \text{the-room}) \rightarrow \neg \diamond \exists x(\text{see}(\text{alex}, x))\})$

We will assume an HPSG syntax and *Lexical Resource Semantics* (LRS, Richter & Sailer 2004) for the syntax-semantics interface, though technical details of the analysis are glossed over. LRS is a constraint-based framework of semantic combinatorics, i.e., words and constructions express *constraints* on the possible readings rather than contributing functions, as is common in LF-based approaches such as Heim & Kratzer (1998). To

express these constraints, we use a constraint language over logical expressions. Lower case Greek letters are meta-variables over expressions of our logical language. The formula in (5) can be stated as:

$\text{Max}(\{d|\alpha\}) \geq \text{Min}(\{d|\alpha \rightarrow \neg\Diamond\exists x(\text{see}(\text{alex}, x))\})$, where α is a meta-variable which is assigned the value **dark**(d , **the-room**). LRS uses *subexpression constraints* of the form $\alpha[\phi_1, \dots, \phi_n]$, where α and ϕ_1, \dots, ϕ_n are meta-variables. This subexpression constraint specifies that α can only refer to a logical expression that contains ϕ_1, \dots, ϕ_n as subexpressions.

We follow Sailer & Am-David (2016) in the basic assumptions about the distinction of asserted and non-asserted content (Potts, 2005): The relevant level of semantic representation contains the information on the resolution of anaphora and the accommodation site of presuppositions and conventional implicatures (CI), but still marks presuppositions and CIs as distinct from asserted content.

Analysis of RCXs Given this inventory of analytic tools, we can develop our analysis. We will first provide a representational rendering of Krifka’s notion of *emphatic assertion*. We will show how this can be integrated into an analysis of RCXs that account for our observations (OBS1–OBS3). We, then, extend this analysis to second-order RCXs. Finally, we show how this interacts with a representational theory of NPI-licensing.

Exhaustification operator Alternative semantics and scalar interpretations have led to a formalization of intuitions about information structure (Rooth, 1985; Krifka, 1984), and E-NPIs and NPIs in general (Krifka, 1995; Eckardt, 2005; Chierchia, 2006). The basic idea is that the asserted content contains an expression that makes available a set of alternatives. The asserted content, then, entails what would have been said had any of the alternatives been asserted instead. We will say that the asserted content *exhausts* the alternatives. Barker (2018) notes that some phenomena make it necessary to express such an exhaustification within embedded contexts. We think that intensifier readings of result clauses are a prime example of this. In (6), we define an exhaustification operator **Exh**.

- (6) For each formula ϕ with subexpression π_τ and each expression $\Sigma_{\tau t}$ that refers to a set of alternatives of π ,

Exh(ϕ, π, Σ) is an exhaustification formula s.th.
 $\llbracket \text{Exh}(\phi, \pi, \Sigma) \rrbracket =$

$$\llbracket \phi \wedge \forall P((P \in \Sigma \wedge \phi') \rightarrow (\phi \rightarrow \phi')) \rrbracket,$$

where ϕ' is just like ϕ but with P replacing π .

This definition is a direct representational reformulation of Krifka’s **scalarAssert** operator and Chierchia’s implicit *O* operator. Since **Exh**(ϕ, π, Σ) is an ordinary formula, we can use it in the constraints contributed by lexical elements and constructions. Typically, the set of alternatives must be contextually given, i.e., Σ will be a free variable in an exhaustification formula.

Exh(ϕ, d, A) expresses a high degree of an adjective that is expressed, where ϕ is the formula containing the adjective’s meaning, d is the actual extent of the adjective, and A the set of contextually relevant alternative degrees. The exhaustification states that the current degree is higher than all the considered alternatives.

First-order RCXs Given the semantic representation of a simple RCI in (5), the RCX contributes the constraint in (7). In English, this constraint will be associated with the degree particle *so*; in Romanian, there is a lexical rule adding this constraint to the specification of a gradable adjective, allowing it at the same time to select an (extraposed) RCI.

- (7) Asserted content of the result construction:
 $\text{Max}(\{d|\alpha\}) \geq \text{Min}(\{d|\alpha \rightarrow \beta\})$,
 where α contains the primary predicate and β the semantic representation of the RCX.

We use a conditional CI to capture the fact that RCXs allow for an intensifier reading if the result clause itself implies all relevant alternatives, see (8). This CI says that if there exists a set of alternatives A such that the content of the result clause (β) is an exhaustification, then the degree expressed in the matrix predicate is extreme.

- (8) CI content of the result construction:
 $\exists A(\text{Exh}(\beta, \gamma, A))$
 $\rightarrow \exists A'(\text{Max}(\{d|\alpha\}) \geq \text{Min}(\{d|\text{Exh}(\alpha, d, A')\}))$

Adding this conditional CI to our lexical specification of the RCX has a number of advantages. First, we derive a plain result reading as in Meier (2003) for an RCI not associated with a high-degree reading. For an RCI with a high-degree reading, we derive the literal reading and we can infer an intensification reading. This is in line with **OBS1** and **OBS3**.

We mentioned that Romanian has different complementizers for result clauses, *încât*, *că* and *de*, where *de* is strongly associated with an intensification interpretation. This means that *de* includes an exhaustification in its asserted content, i.e., it is as in (9) instead of (7). This accounts for **OBS2**.

- (9) Asserted content of result-*de*:
 $\text{Max}(\{d|\alpha\}) \geq \text{Min}(\{d|\alpha \rightarrow \text{Exh}(\beta, \gamma, A)\})$

Second-order RCXs The expressions in (3) have a high degree reading and are bound to RCXs. We provide an example in (10), and we sketch the lexical information of the degree-use of (*de*) *mor* in (11). The asserted content is the same as for high degree readings in general, i.e., the primary predicate α holds to degree d , which is higher than the contextually given alternatives collected in A , see (11a). The set A is presupposed and contains all the contextually relevant possible degrees of the primary predicate. A collocation constraint, (11c), ensures the occurrence in a RCX. We adopt the treatment of collocations in Richter & Soehn (2006).

- (10) Râd de mor.
I.laugh that I.die ‘I laugh very hard.’
- (11) Lexical specification of degree intensifier *mor*:
- asserted content: $\text{Exh}(\alpha, d, A)$
 - presupposition: $\exists A(A = \{d' | \diamond(\lambda d.\alpha)(d')\})$
 - collocation: occurs in a *de*-marked RCL.

With (11), degree-*mor* must signal the highest contextually possible degree and cannot be used outside RCXs.

Analysis of E-NPIs We propose an analysis of E-NPIs that is in line with this approach to RCXs and combines collocation-based and pragmatic NPI-analyses. Pragmatic analyses of E-NPIs (Krifka, 1995; Eckardt, 2005) are based on the idea that these expressions trigger stronger alternatives, but impose a requirement that they are used in the scope of an emphatic operator, i.e., that they express stronger claims than their alternatives. From this, it follows that E-NPIs can only be used in scale reversal contexts. Consequently, contrary to previous HPSG analyses (Tonhauser, 2001; Richter & Soehn, 2006), we don’t introduce a collocational requirement that an E-NPI needs to occur in the scope of negation. Instead, it must occur inside an exhaustification expression.

Let us illustrate this with the E-NPI1 *a (nu) vedea la un pas*. For simplicity, we treat the expression as a holistic unit here, though we implicitly assume a fully lexical analysis as in Kay et al. (ms.) or Bargmann & Sailer (2018).

This E-NPI expresses a minimal range of visibility (12a). As emphatic item, it contributes an exhaustivity operator. The range of visibility is used for emphasis, i.e., the predicate **min-range** appears as the second argument of **Exh**. The set of alternatives, *A*, is a free variable in (12a). The expression presupposes a set of alternative visibility ranges, each of which larger than the minimum, see (12b).

- (12) a. asserted content of *vezi la un pas*:
 $\text{Exh}(\phi[\exists x(\text{min-range}(x) \wedge \text{see}(y, x)), \text{min-range}, A])$
- b. presupposed alternatives:
 $\exists A(\forall P \in A(\forall x(P(x) \rightarrow \text{min-range}(x))))$

Given the way the alternatives are constructed, the exhaustivity requirement can only be met if there is a scale-reversing operator taking scope between the exhaustivity operator and the semantic contribution of the E-NPI. This captures the gist of the alternative-based theories of NPI licensing, within a constraint-based, representational, lexicalist framework.

The semantic representation of a sentence with this E-NPI is shown in (13). Since the existence of an appropriate set of alternatives is lexically presupposed, presupposition accommodation above negation will ensure that these alternatives will be used as the value of *A*.

- (13) Maria nu vede la un pas.
Maria not sees within a step
 $\text{Exh}(\neg \exists x(\text{min-range}(x) \wedge \text{see}(m, x)), \text{min-range}, A)$

	T1	T2	T3	T4
E-NPI1: (<i>in 1st-order RCX</i>) <i>a (nu) se vedea la un pas</i>	✓	✓	✓	✓
E-NPI2: (<i>in 1st-order RCX</i>) <i>a (nu) se vedea om cu om</i>	✓	✗	✓	✓
E-NPI3: (<i>in 2nd-order RCX</i>) <i>a (nu) te vedea</i>	✗	n/a	✗	✗

Table 1: Distinguishable E-NPI classes in RCXs

With the lexical specification in (12), the E-NPI can occur freely outside RCXs (T1, T2). When we embed sentence (13) in a RCX, the antecedent of the CI in (8) is satisfied and, thus, an intensifier inference is possible. Since it is the minimizer that contributes the alternatives, we can get this intensifier inference independently of the choice of the complementizer (T3). The asserted meaning of the clause containing the E-NPI is part of what is asserted when used in a RCX (T4). For an E-NPI that can only occur in RCX-contexts (E-NPI2 and E-NPI3), we can add a collocational requirement, given in (14). We use **npi** as a placeholder for the alternative-triggering semantic contribution of the expression. The constraint expresses that the exhaustivity operator contributed by the E-NPI must occur in a result/degree semantics.

- (14) RCX-collocational requirement:
 $\text{Max}(\{d|\alpha\}) \geq \text{Min}(\{d|\delta[\text{Exh}(\phi, \text{npi}, A)]\})$

E-NPI2s have a lexical specification analogous to (12), but with the collocation constraint (14). This accounts for their behavior with respect to our tests: they are like E-NPI1s with respect to all tests but T2.

Finally, we can consider E-NPI3s. They lost their literal meaning and only express a high degree. In the talk, we will adapt the analysis of (*de*) *mor*, from (11), to NPIs so as to account for the properties of E-NPI3s.

Conclusion Romanian degree result clauses show an intricate interaction of complementizer choice and lexical material inside the result clause. A lexical, constraint-based analysis can capture this in an interesting way: Emphatic NPIs contribute a scalar operator. This triggers a high degree reading when used in degree result clauses. The complementizer *de* requires a high degree reading, which makes it the natural choice for result clauses with emphatic NPIs. Second-order result clause constructions have a bleached interpretation of the result clause material but are semantically compatible with the requirements of *de*. Our analysis relies on a scalar exhaustification operator, which is integrated into semantic representations. Consequently, we arrive at a purely representational version of scalar theories.

Tests

- (15) T1 (E-NPI1 & E-NPI2)
- E aglomerație pe străzi în timpul
There.is crowd in streets during
grevei [de nu se vede la un pas]/
strike.the that not REFL see within a step/

[de nu se vede om cu om].

that not REFL see person with person

‘There is a huge crowd in the streets during the strike.’ (lit.: There is a crowd **that** one cannot see a step ahead/ **that** one cannot see the person in their immediate range of sight.)

- b. = E aglomeratie pe străzi în timpul grevei [și nu se vede la un pas]/ [și nu se vede om cu om].

(lit.: There is a crowd **and** one cannot see a step ahead/ **and** one cannot see the person in their immediate range of sight.)

(16) T1 (E-NPI3)

- a. Mi-e foame [de nu te văd].
to.me-it.is hunger that not you I.see
‘I am extremely hungry.’ (lit.: I am hungry **that** I cannot see you.)

- b. ≠ Mi-e foame [și nu te văd].
(lit.: I am hungry **and** I cannot see you.)

(17) T2 (E-NPI1 & E-NPI2)

Mergeam pe stradă [și nu se vedea la un pas]/ [#și nu se vedea om cu om].

(lit.: I was walking down the street **and** one could not see a step ahead/ **and** one could not see the person in their immediate range of sight.)

(18) T3 (E-NPI1 & E-NPI2)

E întuneric [de/ încât nu se vede la un pas]/ [de/încât nu se vede om cu om].

It.is dark that not REFL see within a step/ that not REFL see person with person
‘Outside is very dark.’

(19) T3 (E-NPI3)

Mi-e foame [de/#încât nu te văd].
to.me-it.is hunger that not you I.see
‘I am extremely hungry.’

(20) T4 (E-NPI1 & E-NPI2)

Ninge a. [de nu se vede la un pas]/b. [de nu se vede om cu om].

‘It is snowing very hard.’

(lit.: It is snowing that one cannot see a step ahead/that one cannot see the person in their immediate range of sight.)

Entails: a. Nu se vede la un pas./b. Nu se vede om cu om. (result reading: *lack of visibility*)

(21) T4 (E-NPI3)

Mi-e foame [de nu te văd].
‘I am extremely hungry.’

(lit.: I am hungry that I cannot see you.)

Does not entail: Nu te văd. (no result reading)

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