

# Termination of Derivation and Intonational Phrasing: A Preliminary Study

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**ABSTRACT.** It has generally been argued that intonational phrases are formed in terms of semantic properties (Selkirk 1984, 2005). In this paper, I propose a new theory of intonational phrasing, based on the notion of the termination of a derivation that is formulated with reference to a workspace of the syntactic computation (Chomsky, Gallego and Ott 2017). Specifically, I suggest that the domain of a terminated derivation is interpreted as an intonational phrase. The proposed theory is a null hypothesis in that it does not require any additional mechanism that forms intonational phrases. Moreover, it does not need to refer to any semantic information, which should not be available to the syntax-phonology mapping in the grammatical architecture where there are no semantics-phonology interactions. I show that the proposed theory gives a straightforward account of various types of intonational phrases including the typical ones discussed in Nespor and Vogel (1986).\*

**Keywords:** MERGE, workspace, termination, intonational phrase, Pair-Merge

## 1. Introduction

The purpose of this paper is to examine the phonological consequences of the notion of termination of derivation formulated in terms of workspace WS (Chomsky 2017, Chomsky, Gallego and Ott 2017). In the derivational architecture of grammar, it is necessary to terminate the computation at some point of derivation, otherwise linguistic expressions cannot be “used” in the extraneous systems. I argue that a terminated derivation is interpreted as a domain of intonation (Intonational Phrase IntP). I show that this approach can dispense with the reference to semantic properties in the formation of IntP, unlike the previous approaches and the more recent Match Theory that has been pursued by Selkirk (2009, 2011).

This paper is organized as follows. In section 2, I examine the previous approaches to intonational phrasing, and point out that they require semantics-phonology interactions, which cannot be formulated in the architecture of grammar where syntax feeds semantics and phonology. In section 3, I briefly introduce the notion of WS and the formulation of MERGE

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- (3) a. [<sub>CP</sub> Comp<sup>0</sup> [ standard clause ] ]  
 b. [<sub>ForceP</sub> Force<sup>0</sup> [ illocutionary clause ] ]

(3a) accounts for the IntP of a simple sentence. However, it would not account for the well-established observation that an IntP corresponds to a root sentence (Downing 1970: 28, Emonds 1976: 44, Nespor and Vogel 1986: 188). For example, in (4), the embedded CP is not separated by comma intonation, a typical characteristic of IntP boundaries:

- (4) You realize (that) the books have already arrived. (Emonds 1976: 44)

It seems that (3a) cannot distinguish the root CP from the embedded one in (4). Moreover, (3a) is a category-specific formulation, which would need to be independently motivated on principled grounds.

(3b) seems to be intended to account for the fact that parentheticals, non-restrictive relative clauses, and other semantically similar expressions constitute IntPs. Potts (2005: 92) identifies these expressions as “supplements” that do not affect the “at issue” meaning of their host sentence. Selkirk (2011) argues that these are instances of an “illocutionary clause”, and (3b) accounts for the following instances of IntPs. The examples are from Nespor and Vogel (1986: 188):

- (5) a. Lions [as you know] are dangerous.  
 b. My brother [who absolutely loves animals] just bought himself an exotic tropical bird.  
 c. [Clarence] I'd like you to meet Mr. Smith.  
 d. [Good heavens] there's a bear in the back yard.

These are instances of parentheticals (5a), non-restrictive relative clauses (5b), vocatives (5c) and expletive expressions (5d), all of which do not affect the at-issue meaning of their host sentences. Moreover, as Potts (2005: 93) points out, the appositives in nominal appositive constructions are also supplements and constitute IntPs:

- (6) Chuck, [a confirmed psychopath],

Here, the appositive *a confirmed psychopath* is a supplement, and it is set off by comma intonation (see also de Vries 2012).

However, as Potts (2005: 92) points out, intonational phrasing of the “slifting” constructions (Ross 1973) and tag questions cannot be accounted for in terms of supplement:

- (7) a. Max, [it seems], is a Martian.

b. Max is a Martian, [isn't he]

Potts (2005: 92)

(7a) and (7b) are equivalent to “It seems that Max is a Martian” and “Is Max a Martian?”, respectively. In other words, the parenthesized parts in (7a, b) do not provide a secondary proposition that has supplementary semantic content. Nonetheless they constitute IntPs. Furthermore, the dislocated expressions, which do not have a secondary proposition either, also correspond to IntPs:

(8) They are so cute [those Australian koalas].

Nespor and Vogel (1986: 188)

Given these considerations, (2a)/(3) does not seem to offer a unified account of intonational phrasing. In addition to these empirical problems, Match Theory seems to have some theoretical shortcomings. First, as we have just seen, (2a)/(3) requires semantic information that is not supposed to be available to the syntax-phonology mapping since the grammatical architecture in the minimalist syntax does not allow semantics-phonology interactions (I will return to this issue in section 5). Second, it is not clear how to formally distinguish a clause from a phrase in (2a, b). A clause CP is just a kind of phrase XP. It has been recognized that the distinction between function and content words can be made in the syntax-phonology mapping (e.g., Selkirk 1984, Truckenbrodt 1999), but it would not be the case that C and T, or C and  $v^*$  (both of these are phase heads), for example, can be distinguished in the syntax-phonology mapping. Third, in the theory of phrase structure in the minimalist syntax, labels and projections themselves are considered to be derivative (Chomsky 2013, 2015) or even undefinable (Collins 2002). Match Theory crucially rests on these concepts, which do not have any solid theoretical basis.

In section 4, I will argue that the notion of termination of derivation gives a unified account of intonational phrasing. Before moving on to section 4, I will briefly introduce in section 3 the notions of MERGE, workspace, and termination of derivation that will form the basis of the proposed theory.

### 3. MERGE, Workspace and Termination of Derivation

In the earlier period of the minimalist program, Chomsky (1995: 243) defines the structure-building operation Merge as follows:

(9) “Applied to two objects  $\alpha$  and  $\beta$ , Merge forms the new object K, eliminating  $\alpha$  and  $\beta$ .”

As Chomsky (2017) points out, it is not explicitly stated here “from what”  $\alpha$  and  $\beta$  are eliminated. He argues that they are actually eliminated from a workspace WS, and that Merge

is in fact an operation that applies to WS and updates it to a modified workspace WS' (see also Chomsky, Gallego and Ott 2017). He calls such an operation MERGE. Thus, applied to WS in (10a), MERGE updates it to WS' in (10b), where  $\alpha$  and  $\beta$  have been eliminated.

- (10) a. WS = [  $\alpha$ ,  $\beta$ ,  $\gamma$ ,  $\delta$  ]  
 b. WS' = [ K,  $\gamma$ ,  $\delta$  ], where K = { $\alpha$ ,  $\beta$ }

Chomsky (2017) and Chomsky, Gallego and Ott (2017) show that this formulation can successfully restrict the range of possible MERGE on principled grounds, although I will not go into detail since it goes far beyond the scope of this paper.

Let us next consider the termination of a derivation in the theory of MERGE. In the earlier minimalist framework, it is formulated with reference to numeration. Thus, Chomsky (1995: 225ff) states as follows (see also Chomsky (2000: 106) for the termination in the phase-by-phase computational system):

- (11) “Viewing the language L as a derivation-generating procedure, we may think of it as applying to a numeration N and forming a sequence S of symbolic elements ( $\sigma_1, \sigma_2, \dots, \sigma_n$ ), terminating only if  $\sigma_n$  is a pair ( $\pi, \lambda$ ) and N is reduced to zero (the computation may go on).”

In the framework of MERGE, Chomsky, Gallego and Ott (2017: 20) give the following definition of termination, which refers to WS but not to numeration:

- (12) “A derivation may (but need not) terminate whenever WS contains a single object; if it terminates in any other situation, no coherent interpretation can be assigned.”

Given this definition of termination, let us consider the derivation of the following schematic example of a simple transitive construction like *John hit Bill*:

- (13) [CP C [TP Subj T [v\*P tSubj v\* [VP V Obj ]]]]

The first phase of this derivation, i.e. v\*P, is derived as follows:

- (14) a. WS1 = [ Subj, v\*, V, Obj ]  
 b. WS2 = [ {V, Obj}, Subj, v\* ]  
 c. WS3 = [ {v\*, {V, Obj}}, Subj ]  
 d. WS4 = [ {Subj, {v\*, { V, Obj}}} ]

In (14a), WS1 contains four lexical items. Merge applies to WS1, and updates it to WS2, as in (14b). Here, V and Obj have been eliminated and replaced by {V, Obj}. Then, MERGE

applies to WS2 and we have WS3, where  $\{V, Obj\}$  and  $v^*$  are replaced by  $\{v^*, \{V, Obj\}\}$ . Finally,  $Subj$  and  $\{v^*, \{V, Obj\}\}$  are eliminated from WS3, and we have WS4 consisting of a single object. Suppose that no new lexical item is introduced into WS4. Then, given the definition of termination in (12), the derivation may terminate here since WS4 contains just the single object of  $\{Subj, \{v^*, \{V, Obj\}\}\}$ . However, if it terminates, the derivation crashes because of the unvalued Case feature of  $Subj$ . Suppose instead that the derivation goes on to the next phase level CP:

- (14) e.  $WS5 = [ \{Subj, \{v^*, \{V, Obj\}\}\}, C, T ]$   
 f.  $WS6 = [ \{T, \{Subj, \{v^*, \{V, Obj\}\}\}\}, C ]$   
 g.  $WS7 = [ \{Subj, \{T, \{Subj, \{v^*, \{V, Obj\}\}\}\}\}, C ]$   
 h.  $WS8 = [ \{C, \{Subj, \{T, \{Subj, \{v^*, \{V, Obj\}\}\}\}\}\} ]$

In (14e),  $C$  and  $T$  are drawn from the lexicon and added to the WS4, and we have WS5. MERGE updates WS5 to WS6, as in (14f). Here, External Merge has applied to  $T$  and  $\{Subj, \{v^*, \{V, Obj\}\}\}$ . Then MERGE applies to WS6, yielding WS7, where  $Subj$  has undergone Internal Merge. Then, MERGE applies to WS7, updating it to WS8, where External Merge has applied to  $C$  and  $\{Subj, \{T, \{Subj, \{v^*, \{V, Obj\}\}\}\}\}$ . WS8 completes the CP phase, and contains just a single object where all the uninterpretable features have been valued. Suppose that the derivation terminates at this point. Then, it converges at the interfaces, and the single object receives interpretation and gives instructions to the extraneous systems.

In the next section, I will argue that it is this kind of single object that is regarded as an Intonational Phrase  $IntP$  in the processes of externalization (the phonological component).

#### 4. Syntax-Phonology Interface

In the study of syntax-phonology interface, it has been argued that a domain of phase-by-phase TRANSFER (or Spell-Out, see Chomsky 2004: 107) corresponds to a phonological phrase  $PhP$ , which is intermediate between the level of prosodic word  $PrW$  and that of intonational phrase  $IntP$  in the prosodic hierarchy (see (1)). As discussed in Dobashi (2003), this approach to phonological phrasing is a null hypothesis, since it does not require any additional theoretical apparatus that forms phonological phrases, unlike the traditional theories such as Relation-based Theory (Nespor and Vogel 1986) and End-based Theory (Selkirk 1986). However, the TRANSFER-based approach compares unfavorably with the traditional theories and Match Theory in that it just accounts for phonological phrasing and it is unable to give a unified account of the entire prosodic hierarchy. In what follows, I attempt

to give a principled account of intonational phrasing. I'll leave an account of the PrW formation for future research.

Given the formulation of the termination of a derivation in (12), one would expect that a single object in WS resulting from the termination could serve as a unit of interpretation at the interfaces. That is, the computation of narrow syntax could demarcate a meaningful domain at the interfaces by virtue of the termination. Since this domain is generally larger than the domain of phase-by-phase TRANSFER, let us suppose that it corresponds to an IntP in the phonological component.

(15) The domain of a terminated derivation corresponds to an IntP.

In this approach, the computation of narrow syntax provides two kinds of meaningful domains at the sensorymotor interface: One is a domain of phase-by-phase TRANSFER, which is interpreted as a PhP, and the other is a domain of a terminated derivation, which is interpreted as an IntP. These are just by-products of the syntactic derivation, and we do not require any additional device that creates these domains, unlike the previous theories. Thus, we do not need the COMMA feature of Potts (2005) (see also Selkirk 2005) or par-Merge of de Vries (2012) (see also Dehé 2014). That is, (15) is a null hypothesis.

Given (15), let us first consider the intonational phrasing of a simple transitive construction (13), and its derivation (14), repeated here as (16) and (17), respectively:

(16)  $[_{CP} C [_{TP} \text{Subj } T [_{v^*P} t_{\text{Subj}} v^* [_{VP} V \text{Obj} ]]]]$

- (17) a. WS1 = [ Subj, v\*, V, Obj ]  
 b. WS2 = [ {V, Obj}, Subj, v\* ]  
 c. WS3 = [ {v\*, {V, Obj}}, Subj ]  
 d. WS4 = [ {Subj, {v\*, {V, Obj}}} ]  
 e. WS5 = [ {Subj, {v\*, {V, Obj}}}, C, T ]  
 f. WS6 = [ {T, {Subj, {v\*, {V, Obj}}}}, C ]  
 g. WS7 = [ {Subj, {T, {Subj, {v\*, {V, Obj}}}}}, C ]  
 h. WS8 = [ {C, {Subj, {T, {Subj, {v\*, {V, Obj}}}}}} ]

As we have seen above, this derivation can terminate without crashing only at the stage of (17h). That is, (15) correctly predicts that the entire sentence is an IntP. Notice that this approach does not need to stipulate that a specific phrase, say CP, is an IntP, unlike Match Theory. It also accounts for why another strong phase v\*P (the syntactic object in (17d)) is not an IntP: the derivation will crash due to the unvalued Case of Subj if it terminates at the stage of (17d).

Let us next consider the complex sentence (4), repeated in (18):

(18) You realize (that) the books have already arrived. (Emonds 1976: 44)

Here, the embedded CP does not correspond to an IntP, but the entire sentence does. If the derivation terminates at the embedded CP, the following single object is obtained at the interfaces:

(19) (that) the books have already arrived

Whether *that* is overt or not, the C of this clause serves to introduce a subordinate clause, unlike the root C, and it needs to be selected, otherwise (19) would result in gibberish. Therefore, it does not constitute an IntP, or perhaps it is a felicitous IntP since the derivation can terminate and converge, but with unnatural semantic interpretation. Either way, the embedded CP in (18) cannot be an IntP, and the derivation should go on to provide appropriate instructions for the interfaces. When the derivation reaches the root CP, it can terminate, and is interpreted properly at the interfaces. Therefore, the domain of this terminated derivation is an IntP, which is a root clause. Again, this approach does not need to stipulate that only the root CP can be an IntP. It follows from the termination and interpretation at the interfaces.

Let us next consider the other instances of IntPs one by one, which we have seen in section 2. Let us first consider parenthetical and non-restrictive clauses in (5a,b), repeated in (20):

(20) a. Lions [as you know] are dangerous.  
 b. My brother [who absolutely loves animals] just bought himself an exotic tropical bird.

Potts (2002a, b) argues that parenthetical *as*-clauses as well as non-restrictive relative (NRR) clauses involve operator movement, and their differences are reduced to the semantic types of the gaps (traces) left by the operator movement. Notice that the derivation of these clauses can terminate and converge independently of the matrix clauses since all the uninterpretable features can be valued within the clauses, and since they are not transformationally related to their host sentences (that is, nothing moves from within the *as*-/RNR clauses into the host sentences), but they are semantically (i.e., post-syntactically) related through function application. Therefore, these clauses correspond to an IntP. Note that terminated derivation can still undergo MERGE since nothing blocks it. Thus *as*-/RNR clauses undergo MERGE and are integrated with the host sentences, and the relation between

them is calculated in the semantic component, post-syntactically (see Potts 2002a, b for details). (Note that it would be necessary to assume that a derivation must terminate if it can, since otherwise the IntP-hood of *as*-/RNR clauses would be optional, contrary to fact. I'll leave this issue open here.)

Let us next consider (5c, d), repeated in (21):

- (21) a. [Clarence] I'd like you to meet Mr. Smith.  
 b. [Good heavens] there's a bear in the back yard.

Vocatives and expletive expressions in (20a, b) can terminate and converge on their own, since they have only interpretable features and are not assigned any uninterpretable features such as Case when they enter the WS (see Chomsky (2000: 95) for a relevant discussion on convergence). Therefore, they correspond to IntPs.

Let us next consider appositive nominal construction (6), repeated here in (22):

- (22) Chuck, [a confirmed psychopath],

Again, the appositive can terminate and converge on its own. It is semantically, but not transformationally, related to its host, just like the *as*- and NRR clauses that we have seen above (see Potts 2005). Note, however, that there are some complicated and interesting issues with regard to what Case form the appositive takes (see Potts 2005: 107ff.), which I will not discuss here.

Let us next consider the example of slifting (7a), repeated in (23):

- (23) Max, [it seems], is a Martian.

Haddican et al. (2014) argue that slifting constructions involve movement of the operator that is coindexed with the matrix clause (see Collins and Branigan 1997 and Collins 1997 for the similar analysis of quotative constructions) just like the *as*- and NRR clauses that we have seen above, and that the two clauses are generated independently and they are not linked through transformation (Jackendoff 1972). Then, the slifted clause can terminate and converge by itself, corresponding to an IntP.

Let us consider the tag question (7b), repeated in (24):

- (24) Max is a Martian, [isn't he]

Culicover (1992) points out that tag questions have a pronominal character in that they have a pronominal copy of the main clause subject, a copy of the main clause auxiliary, and the elliptical counterpart of the matrix VP. Given this observation, Culicover argues that a tag question involves [+pro] IP, and the interpretive rule takes the tag question as the function

and the matrix IP as the argument. This indicates that the relation between the tag and the matrix clause is not transformational. That is, the tag can terminate and converge independently of the matrix clause, and therefore it corresponds to an IntP.

Lastly, let us consider the dislocation (8), repeated in (25):

(25) They are so cute [those Australian koalas]. Nespor and Vogel (1986: 188)

Ott and de Vries (2013) argue that right dislocation constructions in fact have biclausal structure, and that the second clause has undergone deletion. Thus, the right dislocation construction in Dutch shown in (26a) has the biclausal structure as in (26b), where two CPs are juxtaposed and deletion applies to the latter (Ott and de Vries 2013: 6):

- (26) a. Tasman heeft ze gezien, die Maori's [Dutch]  
 Tasman has them seen those Maoris  
 'Tasman saw them, those Maoris.'
- b. [<sub>CP1</sub> Tasman heeft ze gezien ] [<sub>CP2</sub> die Maori's<sub>i</sub> [~~heeft Tasman <sub>i</sub> gezien~~]]

Here, the “right-dislocated” phrase *die Maori's* is topicalized in CP2, and the residual part undergoes PF-deletion (indicated by strikethrough). Ott and de Vries argue that this analysis not only dispenses with rightward movement, but also accounts for a fuller range of data than other alternative mono-clausal analyses. They (p.29) point out that this analysis can be taken over to English right dislocation constructions. If so, the right dislocated material is included in the independent CP, which can terminate and converge on its own, and corresponds to an IntP. As Ott (2012, 2015) argues for the similar bi-clausal, deletion analysis of left-dislocation, it would be possible to extend the similar analysis of intonational phrasing to the left-dislocation constructions since they usually show comma intonation.

So far, I have argued that the derivations that can terminate and converge correspond to IntPs. Although the discussion so far does not exhaust all the typical cases of intonational phrasing, it seems that the proposed approach can offer a simple and unified account of the apparently heterogeneous set of IntPs in terms of the notion of termination.

## 5. Implications and Conclusion

We have discussed the relation between syntax (termination) and phonology (IntP). As is well known, intonational phrasing is susceptible to performance factors such as speech rate, but it seems that its basic phrasing is determined in terms of syntax (see Nespor and Vogel 1986: 187). So I assume that the basic or default phrasing is a matter of competence, and the variations induced by performance factors such as speech rate are superimposed on the

default phrasing in the extraneous systems. Although a theory of performance may allow semantics-phonology interactions (cf. Chomsky 1995: 220), the basic architecture of generative grammar assumes that there are no direct semantics-phonology interactions. Then, basic intonational phrases should in principle be demarcated without reference to semantic information. In spite of this, the previous analyses of intonational phrasing have rather extensively relied on semantic information. For example, Selkirk (1984: 286) proposes the following condition:

(27) *The Sense Unit Condition on Intonational Phrasing*

The immediate constituents of an intonational phrase must together form a sense unit.

This kind of “semantic” approach to intonational phrasing seems to be taken over to the current theories like Match Theory as we have pointed out in section 2. There seem to have been few attempt to frame the theory of intonational phrasing strictly within the architecture of grammar that disallows semantics-phonology interactions. (An exception is Nespor and Vogel’s (1986: 189) theory. They suggest that “a string that is not structurally attached to the sentence tree” corresponds to an IntP. But they do not explicitly state what “not structurally attached” means.)

The proposed theory, however, does not require any semantic information. The phonological component just regards the terminated derivation as an IntP, without referring to the semantic content. Note that the semantic component should be able to make use of the terminated derivation as well. Then, the apparent semantics-phonology interactions in intonational phrasing can be reduced to the fact that the same syntactic object demarcated by the termination is interpreted as a meaningful domain at both the interfaces. Thus a terminated derivation TD is regarded as an IntP in the phonological component, and the same TD is interpreted as, say, an illocutionary clause, at the conceptual-intentional interface. The proposed approach explains why a “sense unit” appears to correspond to an IntP: These are indirectly linked through the medium of the narrow-syntactic notion of the termination of a derivation, without any direct interaction between them.

Another implication is that it might be the case that Pair-Merge (adjunction; see Chomsky 2004) can be recast as MERGE targeting a terminated derivation. All the IntPs we have discussed are usually assumed to be integrated into the structure via adjunction (I’m putting aside the cartographic approach to the left periphery (Cinque 1999, cf. Ernst 2002)). That is, the distinction between Set-Merge and Pair-Merge could be reduced to the termination of a derivation. All we have is just simple Set-Merge, and if it targets a syntactic object SO whose

derivation has terminated, then this SO is regarded as an adjunct. On the assumption that no syntactic operation can look into the terminated part of the derivation (on a par with the phase impenetrability condition PIC, which is reducible to a third factor principle of efficient computation), we can account not only for the well-known islandhood but also for the Par-Merge effects (de Vries 2012). As observed by de Vries (2012: 155), c-command relations cannot be held across the boundary of a parenthetical clause. Thus, a variable binding fails as in (28), and Condition C effects do not show up as in (29):

- (28) a. [No climber]<sub>i</sub> talked about the mountain he<sub>i</sub> conquered last month.  
 b. \* [No climber]<sub>i</sub> talked about the K2, which he<sub>i</sub> conquered last month.
- (29) He<sub>i</sub> said – this is typical for Joop<sub>i</sub> – that he<sub>(i)</sub> didn't like veggie burgers.

If the domain of termination is made invisible to c-command relations (perhaps a stronger form of PIC), then we would not need the additional structure-building operation of Par-Merge.

A problem, among probably many others, would be that not all the adjuncts constitute IntPs:

- (30) John played the guitar in the park

Here, the PP *in the park* is a typical adjunct and it can terminate and converge, but usually it does not correspond to an IntP. However, it might be the case that if the PP terminates in the derivation of (30), then the semantic interpretation would fail, just as in the case of the embedded CP discussed below (19). As Ernst (2002) argues, not only *John* and *the guitar* but also the PP *in the park* is a participant of the event. So, all of the participants, whether they are arguments or adjuncts, should be in the same interpretive domain so that the event denoted by the derivation of (30) can be assigned a coherent interpretation at the conceptual-intentional interface. This is illustrated below:

- (31) [<sub>E</sub> Play(e) & Agent (e, John) & Theme (e, guitar) & Locative(e, park)]

Therefore, the derivation should go on after the PP is constructed so that it is included in the same event domain. As a result, the PP is included in the IntP corresponding to the entire sentence. This is different from the case of, e.g., a NRR clause. The NRR clause is a function and the host sentence is its argument, and they are different propositions. So the NRR clause and its host sentence can be (or perhaps should be) different terminated derivations, and hence different IntPs. I will leave technical details of these issues open for future research.

In this paper, I have proposed a new theory of intonational phrasing, based on the notion

of the termination of a derivation that is formulated with reference to WS. The proposed theory is a null hypothesis in that it does not require any additional mechanism that forms intonational phrases: The domain of a terminated derivation is interpreted as an IntP. I have shown that the typical intonational phrases discussed by Nespor and Vogel (1986) and others can be accounted for in a straightforward way.

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