The interaction between grammar and processing in intervention locality

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1 Introduction

An everlasting question within linguistic theory is about the source of locality effects. Indeed, although an accurate cross-linguistic characterisation of the latter has been made available through a terrific amount of theoretical and experimental work, the fundamental underpinnings of their emergence remain subject to ongoing debate. In particular, a central issue is whether locality effects are driven by syntactic rules or by general principles of language processing (see Dillon and Hornstein 2013 for an overview). A way to rephrase the question is the following: does locality pertain to properties specific to the language faculty? Or is it rather the outcome of independent principles of our cognition?

This paper attempts to contribute to the debate advancing the hypothesis that local constraints in syntactic dependencies are modulated at the interface between the grammar and performance systems, building on former proposals by Hawkins (1999) and Boeckx (2012). Roughly, the idea is pursued that both grammatical and sentence-processing factors directly affect the outcome of long-distance dependencies, giving rise to (at least a subclass of) the phenomena that we know as locality effects. In support of this claim, some experimental data are reviewed that point to this exact two-fold nature of locality. Specifically, the argument rests on evidence that intervention locality effects in Spanish object relative clauses and ameliorations thereof presuppose grammatical competence, yet turn on principles of the performance system.

The paper is structured as follows: in Sections 1.1 and 1.2 the two major approaches to locality are briefly reviewed. Section 1.3 introduces a third, less explored alternative to the problem of the source of locality. The main hypothesis of this study is then detailed in Section 2. Section 3 concludes.

1.1 Grammar-based Approaches to Locality

It has long been noticed that the human language shows two different, and in a way opposite traits. In spite of the substantial unboundedness in the length and depth of its structures, single syntactic dependencies seem to be restricted to local domains (see a.o. Stroik 2009, Rizzi 2013, Aboh et al. 2014 for an overview). The effort of describing, understanding, and predicting the make-up of these domains constitutes the theory of locality. As mentioned above, perhaps the most prominent issue within the latter is the identification of what determines the nature and the boundaries of such local domains. There are two main sets of approaches to this question. In this subsection, so-called grammar-based approaches are taken into account.

As the name itself suggests, these approaches indicate the grammar as the origin of locality constraints. In this view, the fact that some syntactic environments are impervious to movement operations is analysed as the outcome of deep syntactic principles that ban extraction out of what, after Ross' (1967) seminal thesis, has come to be known as syntactic islands. The characterisation of these principles has developed through the definition of the structural boundaries demarcating an island. Amongst these are the influential notions of bounding node (Chomsky 1973), barrier (Chomsky 1986), phase (Chomsky 2000, 2001, 2008).[1] What all these share, again, is the fundamental idea that it is the grammar itself that imposes that certain operations be completed within

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[1]For a history of the theories of islandhood, see Hofmeister and Sag (2010), Boeckx (2008b, 2012), Sprouse and Hornstein (2013)

specific configurationally-defined limits (Huang 1982, Chomsky 1986, Rizzi 1990, Cinque 1990, Manzini 1992 a.o.). In a way, locality is seen as a primitive of human grammars.

Whilst likely embraced by most scholars within the generative framework, however, such a steady theoretical stance has not been immune to critiques. Especially in recent years, contributions from different fields have been highlighting a number of issues common to grammar-based approaches. First and foremost, it is apparent that maintaining the innateness of locality constraints carries with it the drawback of lacking a principled explanation. That is, the question of why island constraints exist and why they look as they do is substantially left unanswered (Boeckx 2012:27). What is more, there is an acknowledged (though partial) redundancy in the accounts provided by distinct syntactic principles. For instance, although intended to account for, respectively, strong- and weak-islands (see Szabolcsi 2006, Szabolcsi and Lohndal 2017 for an overview), subjacency-like principles and Relativised Minimality happen to overlap in predicting the ill-formedness of some sentences (Boeckx 2012:23). So much so that proposals have been made to unify locality constraints under a unique theory based on Relativised Minimality alone (Starke 2001, Abels 2003, Rizzi 2009, Zeijlstra 2023).

At a more empirical level, moreover, many have pointed out that the datasets upon which the original generalisations on locality were built (Chomsky 1964, 1986, Ross 1967, Huang 1982) were rather limited and, above all, have been weakened by an extensive number of counterexamples over the years.[2] These, using the words of Hofmeister and Sag (2010), "*have been labeled as 'special', 'peripheral', or 'unique', in the absence of independent motivation*", and have led towards refinements of the theory that have the inevitable flavour of ad-hoc stipulations (see also Chung 1994, Hofmeister 2011, Hofmeister et al. 2013). Not only does such a variability in the emergence of island effects posit a problem to the internal consistency of the theory, it also requires a proper account of how these exceptions can be acquired by the language-learner. And as Phillips (2013a:107) observes, "[...] *to date there are almost no accounts of how island constraints could be learned from the limited data available to children*". A problem, he continues, that "[t]*hose who are skeptical of formal accounts of islands accurately see* [...] *as a serious flaw*".

For these and other reasons, a number of theories have been put forth that look elsewhere than the grammar to account for locality effects. The next subsection briefly reviews their main aspects, as well as some of the most evident issues they come with.

1.2 Reductionist Approaches to Locality

What if locality constraints are not determined by innate, domain-specific principles of the human grammar? What if what we call "syntactic islands", "intervention effects", "blocking categories", ... are instead the mere epiphenomenal outcome of language-independent factors? Questions like these lay the foundations of reductionist theories. *Reductionist*, since what is shared by all these theories is an attempt to *reduce* locality effects to extra-grammatical factors, as Phillips (2013b) brilliantly put it when coining this (by now standard) label. Within this perspective, then, locality is taken to be the result of factors that are outside of the syntactic component and, in essence, independent from it. For instance, such factors have been found in the realm of semantic and pragmatic conditions in question formation (Abrusán 2007, 2011, 2014). Or in information-structural analyses based on discourse cohesiveness (Goldberg 2006).[3] Though what is seemingly the most explored alternative to grammar-based accounts is the idea that locality effects emerge due to limitations imposed by the cognitive system. Indeed, a fairly prolific strand of research has appointed the parser as the source and regulator of locality, building on the intuition that sentences' well-formedness is a function of their computational cost. In this regard, Boeckx (2012:32) writes:

> The general intuition behind reductionist arguments is that island constraints reflect cognitive limits,
> e.g., on attention: island domains are defined by elements that divert the limited resource of attention

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[2]Problematic cases have been found in English as well as in a variety of typologically different languages. See Hofmeister and Sag (2010) and the references therein for a discussion of the individual examples.

[3]These approaches, though typically grouped with other reductionist theories, are not entirely comparable to processing-based accounts. Indeed, whilst they do seek to circumvent syntactic explanations, they still refer to linguistic principles that are genuine parts of the grammatical competence (see Phillips 2013a for a discussion).

away from filler and gaps. Put differently, the idea is that there is a processing cost associated with the operations necessary to build the syntactic structures that we have come to call islands, but, according to the reductionists, islands do not reflect structural constraints. Rather, the perception of unacceptability arises as a by-product of the processing requirements of the relevant sentences.

The goal of reductionism can thus be seen as an attempt to free the grammar from the burden of allegedly superfluous grammatical constraints, explaining locality phenomena in terms of cognitive restrictions that are independently required. Anticipating the discussion in Section 2.3, such a line of reasoning is perfectly in accord with the minimalist endeavour to design the simplest possible grammar. This laudable effort, however, is not quite unhindered. As a matter of fact, processing-based approaches to locality face several challenges that, to date, keep eluding a conclusive resolution. To begin with, much as for grammar-based theories, the cross-linguistic variation in the emergence (and intensity) of locality effects posits a serious a problem for reductionist approaches. Still, whereas theoreticians can always resort to parametric rules to legitimate such differences, it is not so clear how purely processing-based accounts can tackle the issue. Indeed, under the assumption that the human cognition is one and the same for speakers of different languages, the reason why cross-linguistic variations in island taxonomy should emerge is not obvious (Phillips 2013a:97-100). A possibly related problem is that even within the same languages, different effects arise from sentences that should, in principle, bring about equivalent processing difficulties Boeckx (2012:37).

But what is probably the most cogent argument against resource-based accounts is that offered by Sprouse et al. (2012). In the paper, the authors convincingly showed that the lower acceptability ratings associated with the island contexts they tested did not correlate with individual variations in working memory capacities across participants. This result is predicted if locality effects have their source in the grammar, which is, once again, independent of cognitive factors. On the other hand, if island effects are the result of overtaxing processing tasks (Kluender 1991, 1992, 2004), their strength should co-vary with the availability of processing resources, contrary to Sprouse et al.'s findings.

In sum, neither grammar-based nor reductionist approaches rest on fully unassailable premises, both proving to be susceptible to some non-negligible theoretical and empirical inaccuracies. There is, however, yet another approach to locality effects, namely that represented by grounded theories.

1.3 Grounded Approaches to Locality

In a certain sense, grounded theories reconcile the hypotheses of both reductionist and grammar-based accounts. Indeed, grounded approaches tend to make reference to restrictions on language processing, while maintaining that island constraints are mental representations within the speakers' grammar. That is, they are similar to resource-based accounts in advocating arguments based on computational limitations of the parser, but crucially differ from these in ascribing island phenomena to core grammatical rules. Concretely, grounded theories characterise locality constraints as the grammar's reaction to cognitive pressures: sentences that are too hard to process have been progressively ruled out by the syntax (Fodor 1978, 1983, Berwick and Weinberg 1984, Hawkins 1999). It is thus worth to stress out that grounded accounts, rather than a real alternative to grammatical accounts, can be seen as a complementary attempt to explain *why* grammars feature locality constraints and *how* they have come to be over time. Synchronically, these two approaches are in fact substantially equivalent and produce comparable predictions.

2 The Proposal: Locality as an Interface Phenomenon

In this section, the main hypothesis is presented. As will be illustrated, the basic idea is that locality effects reflect the interplay of factors contributed by both the grammar and the parser. That is, locality is construed as a phenomenon at the interface between competence and performance, in a purely Chomskyan sense (Chomsky 1965). To better see the rationale underlying this claim (as well as its implications) some experimental data are first considered that showcase said interaction

between processing and grammar. After that, a broader perspective is adopted to clarify how this could possibly fit in with the general theory of locality.

2.1 Children's Comprehension of ORCs in Spanish

Language acquisition has long proved to be an important window on locality effects (Rizzi 2018). In particular, there has been extensive exploration of how children process and comprehend relative clauses (de Villiers et al. 1979, Goodluck and Tavakolian 1982, Friedmann et al. 2009, Adani et al. 2010, Belletti et al. 2012, Guasti et al. 2012 a.o.). What has consistently emerged from these studies is that children perform overwhelmingly better with subject relative clauses (SRCs) than with object relative clauses (ORCs), which is exactly what one expects happen given that the latter, but not the former, involve intervention locality configurations.[4] This result has been recently confirmed for Spanish in Presotto and Torregrossa (submitted), where children aged 4-7 are reported to comprehend SRCs more than 80% of the times, and ORCs only less than 10% of the times. But more crucially related to the present discussion are the findings of the second part of the study, where the same children were tested with sentences like the following ones:

(1)   a. el niño que saluda el futbolista
           the boy that greet.3SG the footballer
           'The boy that the footballer greets'

       b. el niño al que saluda el futbolista
           the boy DOM.the that greet.3SG the footballer
           'The boy that the footballer greets'

       c. el niño que el futbolista saluda
           the boy that the footballer greet.3SG
           'The boy that the footballer greets'

       d. el niño al que el futbolista saluda
           the boy DOM.the that the footballer greet.3SG
           'The boy that the footballer greets'

These sentences, albeit different on the surface, share one crucial property: they are all perfectly unambiguous ORCs. A SRC interpretation is indeed never an option since each sentence in (1) displays at least one disambiguating cue.[5] Specifically, the presence of differential object marking (DOM), realised with an *a(l)* morpheme in front of *que*, imposes that the relative head is the object in sentences like (1-b,d). Moreover, since Spanish grammar bans pre-verbal direct objects within relative clauses,[6] DPs occurring in front of the verb, like in (1-c,d), can be nothing but subjects. And finally, (1-a) is disambiguated by the absence of DOM: because the post-verbal [+animate, +specific] DP is *not* introduced by DOM, it can only be the subject.[7] In sum, (1-b,c) are disambiguated by one cue each (i.e. DOM and word order, respectively), (1-d) by two simultaneous cues (i.e. both DOM and word order), and (1-a) solely by an instance of what the authors call *in-absentia* cues.[8] Children were additionally tested with a sentence-repetition-task (SRT) that aimed at measuring their mastery of DOM at the time of the experiment.[9]

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[4]Indeed, in the standard analysis of ORCs the subject intervenes between the relative head and its interpretation site (Friedmann et al. 2009, Belletti and Rizzi 2013, Rizzi 2018, Cinque 2020). See also Lau and Tanaka 2021 for an overview on the cross-linguistic variation of subject-object asymmetries in relative clauses.

[5]In the paper, disambiguating cues are defined as "*grammatical properties whose presence or absence implies that a given constituent is either the subject or the object of a given clause*". That is, they allow to tease apart the object from the subject and, hence, construe the relations between the verb and its arguments.

[6]At least under regular pragmatic and prosodic conditions.

[7]See the cited source for an exhaustive characterisation of the stimuli and their make-up.

[8]This label refers to the fact that cues of this type relate their disambiguating capacity to the *absence* of a specific grammatical property. Conversely, overt realisations of DOM (cf. 1-b,d) are, accordingly, *in-praesentia* cues.

[9]More in detail, the task was structured to test children's ability to repeat sentences including DOM in

The results showed that *in-absentia* cues brought about the poorest comprehension (with accuracy rates in sentences like 1-a below 10%) and word order cues in isolation (cf. 1-c) the highest. Somewhat more curious is the impact of DOM cues: they boost children's comprehension when occurring alone (1-b), but lower it when concurrent with word order cues (1-d). That is, word order cues and DOM cues produced a negative interaction. Even more strikingly, the analysis of the SRT revealed that a higher degree of DOM-mastery predicts higher accuracy when DOM occurs in isolation, but lower accuracy when it co-occurs with word order cues, meaning that said interaction gets more pronounced as DOM is acquired. The takeaway is that disambiguating cues of the type in (1) ameliorate children's comprehension of ORCs, but only if they i) are overtly realised, ii) occur in isolation, and iii) are fully acquired.

These results tell us two important things. First: ameliorating cues do not have a fixed, steady impact. Rather, their contribution is modulated by the presence of other cues. Second: whether a cue is effective or not, and to what extent, directly relates to the acquisition of its underlying grammar. In the next subsection, these preliminary conclusions are further developed and integrated within the theoretical debate on locality.

2.2 An Interesting Interaction between Grammar and Processing

At this point, the fundamental question is how to interpret the above pattern within the available approaches to locality phenomena. A first attempt can be done calling upon grammar-based theories, which, so far as intervention locality is concerned, substantially reduce to Relativised Minimality. Pared down to the bone, this account characterises the degree of disruption in the integration of ORCs (and, in fact, any object A-bar dependency) as modulated by the featural specification of the subject and the object: the greater the number of features these two share, the greater the effect. A further proviso is that these features be "syntactically active", meaning that they must be triggers of movement operations (see Rizzi 2018 for an up-to-date review of the theory). Now, even assuming that DOM and word order cues in Spanish do presuppose underlying movement-triggering features, the question remains as to why these bring about ameliorations when occurring in isolation but hinder comprehension when simultaneously realised. If anything, their concurrent presence should strengthen the distinctness of the target (object) and the intervener (subject) and actually boost even better performances.[10]

Conversely, the negative interaction of DOM and word order cues, whereas positing a serious problem to Relativised Minimality, is actually a welcome result within a resource-based approach. The fact that ameliorating cues hinder comprehension when concurrent is indeed expected, as it quite evidently points to working memory limitations: too much information overloads the parser. And at a closer look, even the poor performances with sentences like (1-a) find a fairly natural explanation: the parser is equally impeded when provided with too little information to analyse, as is the case with *in-absentia* cues. This is not surprising, independent evidence shows that covert elements are challenging for children (see Biberauer and Roberts 2012, 2015, Crisma et al. 2020 and references therein). It is thus expected that *in-absentia* cues be not robust enough, especially when compared to overt ones. Somewhat simplifying, we could say that whereas two simultaneous cues are "too much", *in-absentia* cues (alone) are "too little".[11]

A reductionist-like approach thus appears to be better suited to account for the findings discussed in Section 2.1. Less so, however, as soon as the full picture is considered. In particular, the evidence emerging from the SRT highlights that a cue's effectiveness is tightly linked to its acquisition. A fact, this, that is potentially at odds with a purely resource-based approach and, conversely, fully predicted by any grammatical theory. To see why, let us clarify the implications of the SRT's results. What these indicate is that, in the specific case of DOM cues, the impact of DOM (no matter

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contexts of increasing syntactic complexity. In the analysis, DOM mastery was operationalised as a score based on the number of flawless repetitions of DOM-sentences

[10]Or, at least, not constitute an additional impediment

[11]This is, by the way, highly reminiscent of so-called Goldilocks Principle (see Kidd et al. 2012, 2014, Biberauer 2019), whereby children's attention would consistently focus on input that is "just right" (Theresa Biberauer, pc)

whether positive or negative) is a function of the acquisition of DOM-grammar. To put it another way, the effect of DOM cues only arises with children who *know* that an *a/al* morpheme in front of a [human; definite; specific] NP indicates that the latter is a direct object. If such knowledge is unavailable, the parser simply overlooks DOM. Beyond doubt, then, the grammar constitutes a determinant factor: without the requisite grammatical competence, ameliorating cues are virtually futile. But should grammatical competence really be so relevant in a reductionist perspective? If the aim is to only call upon language-independent principles of the *performance* system, it would be actually desirable to leave *competence* aside. As is frequently the case when dealing with locality, then, we find ourselves in front of a stalemate: where grammatical predictions fail, reductionist accounts succeed, and the other way around.

To escape the impasse, a possibility is to trace yet another approach to the problem. One that acknowledges both the grammar and the parser as key factors in the understanding of locality phenomena. This is what constitutes the foundation of the hypothesis pursued in this paper, detailed in what follows.

2.3 Locality at the Interface

The main idea was already introduced in the first lines of this section: locality effects find their source at the interface between the grammar and the performance system. This means, once again, that locality is not determined by grammar alone, nor is it just the incidental outcome of independent constraints on sentence processing. In a certain sense, locality effects surface as these two otherwise independent components interact at their point of connection.

Put it this way, such a conjecture might admittedly sound vague and even a bit far-fetched. Still, there are good reasons to believe that the presented hypothesis, though only germinal, is on the right track. First of all, it is worth emphasising that resorting to an interface-based approach is, at heart, the plain application of minimalist precepts. Within this framework, the very nature of the language faculty is conceived as a "perfect solution" to the needs of the interface systems (Chomsky 1995 and much subsequent work). Further, it is actually desirable to interpret linguistic phenomena as the product of interactions with non language-specific components of the human cognition. An excerpt from Chomsky (2005:10) better elucidates this last point:

> We can regard an explanation of properties of language as *principled* insofar as it can be reduced to properties of the interface systems and general considerations of computational efficiency and the like.

If so, the seek for a principled explanation to locality effects should also rest on the conviction that the interaction between grammar and language processing constraints can and should constitute a crucial factor. And, after all, everyone would likely concur that resorting to independently motivated principles is preferable, when possible, to the postulation of highly idiosyncratic (if not arbitrary) grammatical rules (Boeckx 2012, Dillon and Hornstein 2013) .

Said theoretical soundness is not, however, the only argument in favour of an interface-based hypothesis. The study presented in Section 2.1 also lends support to such an interpretation. Indeed, the conclusion that has been derived from the results is that amelioration effects to intervention locality turn on restrictions on the (child) parser, yet crucially presuppose grammatical competence. Specifically, Spanish children need to acquire the grammar underlying a disambiguating cue in order to make use of it. If they do possess that knowledge, they can overcome the difficulties associated with the integration of structures like ORCs, which exhibit a typical case of intervention configuration. Yet the use of that knowledge is necessarily faced with the limitations imposed by the sentence analyser, which, for instance, is impeded when confronted with excessive material to process. Now, if ameliorations to locality effects and locality itself appertain to the same system, then evidence pointing to the interface nature of amelioration effects is evidence in favour of an interface approach to locality in general. And it is worth mentioning, in this context, that many have already emphasised the connection between island effects and their alleviation, regarding it as a revealing perspective on the very nature of locality (Merchant 2001, 2008, Lasnik 2001, Boeckx 2003, 2008a).

An interface-based approach is not only consistent with theory-internal arguments and (at least in part) empirically supported. It also comes with a number of considerable advantages. Take, for instance, the issues related to the cross-linguistic variability discussed in Section 1.1. The fact that different languages show different locality effects is problematic for both grammatical and reductionist theories. Under the current hypothesis, however, this is not the case. In fact, such variability is predicted: different locality effects emerge as the natural interaction between identical processing principles and non-identical grammars. There is no need to posit any parametrical rule, nor to alter the universal nature of the parser. We simply need to acknowledge that there exist different grammars, with different properties and, conceivably, different island-obviating strategies based on different cues. In this view, cross-linguistic variation in island effects is the mere result of how the parser reads off the grammatical information provided at the interface. Note that, in these terms, even potential acquisitional issues are avoided altogether. If there are no locality constraints encoded in the grammar, children do not need to learn them. Their only task is to acquire the idiosyncratic properties of their target grammars. And locality effects will independently emerge as a function of the parser's capacity to process these properties in what have been hitherto called island contexts.

There are, of course, some problems that might still resist an interface account. One of these is potentially represented by the missed correlation between working-memory resources and the intensity of island effects found by Sprouse et al. (2012) (cf. Section 1.2). It is not clear whether an approach as the one that is advocated here can accommodate these facts, for the availability of computational resources certainly constitutes a prominent factor in the interaction between the parser and the grammar. Still, in the specific context of children's comprehension of ORCs, there is, in fact, evidence showing that individual memory resources directly affects children's capacity to build on different disambiguating cues (Arosio et al. 2012). In this light, it is reasonable to believe that different locality effects need partially different explanation. For instance, intervention locality is probably more prone to an interface account, whereas the strong islands tested in Sprouse et al. (2012) might still call for a more grammar-oriented interpretation. This is not to say that we should renounce to developing a uniform account to locality effects. On the contrary, the identification of different behaviours of island contexts is easily the best way towards a unified account. Reccurring, once again, to Boeckx's lucid wording, *"islands are dynamic, emergent entities"* (Boeckx 2012:121) which, we could add, cannot be made sense of without an equally dynamic theory.

The latter remark prompts one final conjecture, one that reintroduces the grounded theories briefly described in Section 1.3. Undeniably, the hypothesis that is pursued in this paper is not, on balance, so distant from the ideas at the base of grounded accounts. Indeed, both approaches assign a determinant role to the interplay of grammatical and cognitive factors. But if grounded theories offer a picture whereby the grammar is responsive to the needs of sentence processing (Hawkins 1999, 2004), the hypothesis defended here describes a somehow opposite circumstance, namely one where the strategies deployed for the processing of taxing structures are modulated by the different shapes that human grammars can take. These perspectives need not be in contrast. Rather, they likely reflect two sides of the same coin. Or even better, they might account for different stages in the evolution of island contexts. If islands are indeed *dynamic, emergent entities*, it seems legitimate to analyse them as the evolving outcome of a constant interaction between cognitive pressures and grammatical representations.[12]

3 Conclusions

This paper represents an initial attempt to reconsider the problem of the source of locality effects in a different light. In particular, the long-standing dichotomy between grammar-based and reductionist theories is abandoned in favour of a third, intermediate perspective: locality effects are generated at the interface between the grammar and the parser. This way, a series of theoretical and empirical issues concerning the variability of island effects find a rational solution, and, at the same time, the related acquisitional problems are avoided altogether. As shown in Section 2.1, moreover, further

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[12]Possibly, even the apparently contrasting notions of strong- and weak-islands might reduce to the distinction between different "snapshots" of such dynamic evolution.

support to the present hypothesis comes from recent data on children's comprehension of Spanish ORCs. These, while resisting both grammatical and purely resource-based accounts, seem to naturally fit in with an interface theory.

The idea that locality is regulated by an interaction between cognitive and grammatical factors is not entirely new. So-called grounded theories have long proposed that what we call island contexts emerge as the grammar's reaction to exceeding processing costs. More recently, Boeckx (2012) has also suggested that any credible redefinition of locality effects should indeed exploit interface-based mechanisms. The present hypothesis incorporates these ideas into a broader perspective, whereby the notion of locality cannot be dissociated from considerations on how said interface interactions evolved over time, and which forms they assume in different languages.

Needless to say, none of the ideas defended in this paper have, at this stage, a conclusive flavour. They simply constitute a tentative, limited effort to reconcile the vast literature on locality with the programmatic ambition of linguistic minimalism to accomplish a minimally specified grammatical system. The question of how this can be achieved through refined theoretical tools and precise-enough predictions is left for future work.

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