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Syntactic repairs and cyclic optimization

Project Description

The project investigates the phenomenon of repair in syntax, characterizable as a “last resort” operation. Empirically, the project seeks to provide a taxonomy of syntactic repairs. On the theoretical side, the points of departure are a) the idea that repairs lend themselves to an optimality theoretic analysis, and b) that repairs sometimes exhibit opacity effects, which points to optimization being cyclic. a) poses a problem for purely cyclic theories (e.g., the Minimalist Program), b) for purely optimizing theories (such as parallel optimality theory). Accordingly, the project departs from the idea that all repairs in syntax involve cyclic optimization. One question to be answered is what the appropriate size of the cyclic domains is. Another question to be pursued is whether an analysis couched within the Minimalist Program (without ranked and violable constraints) of repair phenomena that preserves the core characteristics of the abstract notion of a repair is feasible.

1 State of the art and preliminary work

The existence of repair phenomena in the syntax of natural languages is relatively well-established (Collins 2001, 48, Grimshaw 2013, 267). The technical notion of a repair that is presupposed here refers to the application of some operation which is usually blocked but which exceptionally and obligatorily takes place in particular contexts in order to avoid greater damage to the syntactic structure to be generated. A textbook example is the phenomenon of English (non-emphatic) *do*-support (Chomsky 1957, 1991, Grimshaw 1997, 2013). In the absence of an auxiliary, the context of negation in English requires the insertion of the minimal verbal element *do* into T (*Mary did not leave* vs. **Mary not left*). Crucially, this only happens if there is negation (and in some other well-defined contexts). In simple declarative clauses, for instance, (non-emphatic) *do*-support is prohibited (**Mary did leave*). Such a definition of repair excludes cases as the repair of (island-)violations by ellipsis or clitic doubling (Ross 1969, Chomsky 1972, Fox & Lasnik 2003, Boeckx & Lasnik 2006, den Dikken 2013, Saab & Zdrojewski 2012), the mending of *that*-t effects by complementizer deletion (Bošković 2017), or the parasitic licensing of otherwise ill-formed relations by a corresponding well-formed relation, as it happens in different contexts (see Richards 1998 on reflexivization, ellipsis, movement from *wh*-islands, weak cross-over, and parasitic gaps). Crucially, in all these cases, the operation that realizes the repair, i.e., ellipsis, complementizer drop, reflexivization, *wh*-movement, and variable binding, applies freely (that is, also in contexts where nothing needs to be repaired). Empirically, repairs show up in a wide range of constructions. In some of these cases, syntax must clearly stand at the center of the analysis. In other cases, though, it is unclear whether really syntax is involved or whether it is more appropriate to analyze a particular repair in terms of morphology or even phonology.

As has been aptly demonstrated in the literature, repair phenomena naturally lend themselves to an optimality theoretic (OT) analysis in terms of ranked and violable constraints (Grimshaw 1997, Legendre et al. 1998, Pesetsky 1998, Müller 2000a, Heck & Müller 2000a,b, Vogel 2001, Heck and Müller 2003, Schmid 2005, Stiebels 2006, Heck 2008, Heck & Müller 2013; see Müller 2000b or Murphy 2019 for overviews). The recurring idea is that the operation O_R that instantiates the repair violates some well-established constraint C_i of the grammar. Therefore, if O_R is not enforced, it is blocked by C_i (the general case). However, if there is a higher ranked constraint C_j (relevant in particular contexts) that runs the risk of being violated by some representation R, then the costs of violating C_i by changing R through the application of O_R (thereby avoiding a violation of C_j) are acceptable. Such a state of affairs is rather hard to account for in other theories. Consequently, repair phenomena constitute a type of phenomenon that serves as a good argument for OT in general. Insofar, they provide an ideal testing ground to investigate theories that employ different types of optimization (parallel vs. various variations of serial optimization; see below), or no optimization at all.

While it may still be the most common assumption in the OT-literature that Harmony Evaluation (the process of optimization) applies in a parallel fashion (i.e., only once and to complete representations, an approach called "harmonic parallelism" by Prince & Smolensky 1993, published as Prince & Smolensky 2004, McCarthy 2000) the alternative view that optimization applies serially, i.e., various times (which was already envisaged by Prince & Smolensky 1993, 2004), has become more and more popular over the years. This is certainly the case for phonology; see Rubach (2000, 2004) for a stratal proposal, which allows for constraint reranking between the strata; for non-stratal serial proposals ("harmonic serialism", Prince & Smolensky 1993, 2004, McCarthy 2000) see, e.g., McCarthy (2008, 2010), McCarthy et al. (2012), Kimper (2016), and Pater (2016). But also syntactic theories have envisaged the serial view of optimization from early on (see Heck 2001 for a stratal approach, and that places a process of interpretive optimization before a process of expressive optimization; furthermore see Ackema & Neeleman 1998, Fanselow & Ćavar 2001, Müller 2000a,c, Fischer 2002, Heck & Müller 2000a,b, 2003, 2007, 2016, Murphy 2017 for various non-stratal serial approaches to optimization in syntax). Since most of the existing serial OT-analyses in syntax (as opposed to phonology) presuppose the principle of the cycle (Chomsky 1965, today hard-wired into Chomsky's 1995 Minimalist Program/ MP through the operation Merge), the serial process of Harmony Evaluation naturally applies in a cyclic fashion in these analyses. Different approaches (in syntax) can then be distinguished by the difference in size of the cyclic domains that they assume to be subject to optimization (e.g., the clause, the phase in the sense of Chomsky 2000, 2001, the phrase, the derivational step). It is in this sense that the notion of cyclic optimization is understood in what follows (cf. Heck & Müller 2000a, Müller 2015, where cyclic optimization is referred to as local, as opposed to global, optimization).

Repair analyses (or, often equivalently, analyses that employ the idea of some operation applying as a last resort) are not unheard of in work pursued outside Optimality Theory. In particular, repairs keep on showing up in analyses that are couched within MP or its predecessors (Koopman & Sportiche 1986, Chomsky 1991, Shlonsky 1992, Corver 1997, Schütze 2002, Benincà & Poletto 2004, Bošković 2006, Franks & Lavine 2006, Řezáč 2008, Béjar & Řezáč 2009, Bjorkman 2011, Řezáč 2011, Kalin 2012, 2014, Coon et al. 2014, Preminger 2014, Sichel 2014, Richards 2016, Pesetsky 2016, Hein 2017, 2018, Martinović 2017; see also Collins 2001 for an overview). However, since MP does not acknowledge violability and relative ranking of grammatical principles, it is unclear whether the intuition captured by a corresponding OT-analysis can be preserved if transferred into MP. In practice, the technical details of a hypothesized repair are generally left implicit in MP-analyses, certainly an unsatisfying state of affairs (a point already stressed by Grimshaw 2013).

The aim of the project is to bring all these perspectives together by a) illuminating the empirical scope of syntactic repairs, b) by developing an explicit theory thereof, based on the hypothesis that optimization (of some kind) is involved, which applies to cyclic domains of a particular size (to be determined), and c) by investigating whether and how MP-analyses that involve the idea of a repair can be re-formulated in an explicit way that preserves the underlying intuition of the notion of repair.

1.1 Project-related publications

1.1.1 Articles published by outlets with scientific quality assurance, book publications, and works accepted for publication but not yet published

- Heck, F. 2000. Tiefenoptimierung – Deutsche Wortstellung als wettbewerbsgesteuerte Basisgenerierung. *Linguistische Berichte* 184, 441–468.
- Heck, F. and G. Müller. 2000. Successive cyclicity, long-distance superiority, and local optimization'. In R. Billerey and B. D. Lillehaugen (eds.), *Proccedings of WCCFL 19*, 218–231. Somerville: Cascadilla Press.
- Heck, F, G. Müller, R. Vogel, S. Fischer, S. Vikner and T. Schmid. 2002. On the nature of the input in Optimality Theory. *The Linguistic Review* 19, 345–376.
- Heck, F. 2008. *On pied-piping –* wh*-movement and beyond*. Berlin: Mouton de Gruyter.
- Heck, F. 2009. On certain properties of pied-piping. *LI* 40, 75–111.
- Heck, F. 2001. Quantifier scope in German and cyclic optimization. In G. Müller and W. Sternefeld

(eds.), *Competition in syntax*, 175-209. Berlin: Mouton de Gruyter.
- Heck, F. and G. Müller. 2003. Derivational optimization of *wh*-movement', *Linguistic Analysis* 33, 97–148.
- Heck, F. and G. Müller. 2013. Extremely local optimization. In R. Vogel and H. Broekhuis (eds.), *Linguistic derivations and filtering*, 136–165. Sheffield: Equinox.
- Heck, F. and G. Müller. 2016. On accelerating and decelerating movement: From minimalist preference principles to Harmonic Serialism. In G. Legendre, M. Putnam, H. de Swart and E. Zaroukian (eds.), *Optimality-theoretic syntax, semantics, and pragmatics*, 78–110.

1.1.2 Other publications, both peer-reviewed and non-peer-reviewed: not applicable

1.1.3 Patents: not applicable

2 Objectives and work programme

2.1 Anticipated total duration of the project 48 months

2.2 Objectives

The project's objective is threefold. The first phase consists of forming a collection of syntactic repair phenomena from various (possibly genetically unrelated) languages. The focus will lie on repairs that are syntactic. For the cases where it is not a priori clear whether the repair involves syntax proper or rather morphology, criteria have to be developed which a decision can be based on. On the basis of the collection, a taxonomy of possible syntactic repairs will be established. It goes without saying that this part of the project is independent of any type of formal analysis and thus can be put to use by later work carried out in against the background of other theoretical assumptions.

In a second phase, it will be investigated whether it is possible to analyze the identified repair phenomena in terms of cyclic optimization. This comprises both repairs that have not received so far an OT-analysis at all (i.e., repairs that have been addressed exclusively at a descriptive level, and repair analyses that are formulated within MP), and repairs for which exclusively a parallel (in contrast to a serial, cyclic) OT-analysis has been given. This part of project unfolds under the working hypothesis $\mathbf{H}_1$ that an OT-grammar of some kind is involved in the analysis of repairs. What is to be investigated, then, is what exactly this grammar looks like. Since arguments for cyclic optimization have already been given (see section 2.3.3), the hypothesis $\mathbf{H}_2$ that will be pursued is that all optimization in syntax is cyclic. Thus, it will be checked for each repair whether an analysis in terms of serial, cyclic optimization can be given. In the next step, it will be determined how large the chunks of structure are supposed to be that are subject to optimization (the cyclic domains). Here, existing analyses diverge, clearly an undesirable state of affairs. Accordingly, the third hypothesis, $\mathbf{H}_3$, is that (most) analyses can be formulated such that they converge upon a uniform cyclic domain. Given that the project is couched within a derivational approach to syntax, this last hypothesis can be further sharpened: There is the general desideratum to reduce the representational residue within any derivational theory. Since every derivation is necessarily composed of a series of steps, the derivational step constitutes the most natural cyclic domain (hypothesis $\mathbf{H}_4$). (Identification of the phrase level as the cyclic domain requires independent characterization of the phrase, perhaps as the domain of complete feature discharge. For the phase such criterion does not even seem to be available. Note also that what is relevant for phase theory is not the maximal projection of the phase-head, i.e., the phase itself, but the phase-head's complement. In any event, the representational residue of the theory increases.)

In a third phase, the question will be pursued whether explicit analyses of repair phenomena that preserve the last resort property of a repair (captured in OT) can be formulated against the background of MP. In this part of the project, hypothesis H_1 is dropped. As mentioned above, the issue of how exactly repairs are to be analyzed in MP is both pressing (because the idea of a repair/ a last resort is both recurrent in MP-analyses while at the same time mostly left implicit) and non-trivial (because of the lack of violable and ranked constraints in this theory). The project will thus aim at finding tools of analysis that allow for an explicit formulation of repairs in MP.

2.3 Work programme incl. proposed research methods

Against the background of these objectives, the following guiding research questions can be formulated.

2.3.1 A taxonomy of syntactic repair phenomena

Q_1) What kind of syntactic repair operations can be found in natural language syntax? A good starting point for an investigation of syntactic repairs consists in establishing a sample of repairs alongside with their characteristic properties. A preliminary collection of repairs comprises at least the following. **a)** Repair-driven lexical insertion may apply in order to satisfy requirements on affix-binding (*do*-support, Grimshaw 1997, 2013), (locality, R-pronouns, Müller 2000a), or creation of specifiers (expletive Vorfeld-*es* Müller 2000b). The common denominator of these operations is possibly a violation of a constraint against insertion of expletives (PRINCIPLE OF FULL INTERPRETATION, Chomsky 1986). **b)** default agreement/case applies in order to satisfy syntactically unvalued probes (Schütze 2002, Schäfer 2013, Preminger 2014); concrete proposals as to what the costs of this operation are have not been made to date. **c)** Repair-driven creation of elements in the numeration has been proposed to apply for case-licensing of arguments (resolution of PCC-violations, Řezáč 2008, 2011), or the satisfaction of the theta-criterion (parasitic gaps, Assmann 2010; obligatory control, Fischer 2012). Possibly, this violates a restriction against modification of the numeration. **d)** Repair-driven movement applies in various contexts where movement is demanded by some high-ranked constraint in the absence of an appropriate feature that could possibly license it (multiple *wh*-movement in sluicing, Merchant 2001, Heck & Müller 2000a, 2003; subject-raising, Richards 2016; symmetry breaking movement for labeling, Blümel 2012, Ott 2012, 2015; locative inversion, Salzmann 2013; relator-movement in predicate inversion, Dikken 2006, 2013). The repair violates a restriction against non-feature driven movement (Chomsky's 1995 LAST RESORT). **e)** Repair-driven realization of copies applies in order to fix island violations (resumption, Koopman & Sportiche 1986, Rizzi 1990, Shlonsky 1992, Ura 1996, Pesetsky 1998, Bayer & Salzmann 2013, Sichel 2014), violations of anti-locality (clitic doubling Grohmann 2003), or in order to satisfy certain visibility requirements (*wh*-copying, Fanselow & Ćavar 2001). It violates restrictions on (multiple) spell-out. **f)** Repair-driven structure change has been proposed as a repair for locality violations in contexts such as raising across experiencers, absolutive case assignment in transitives (Stepanov 2001a,b, 2004), or ECM-raising (under the assumption that the infinitive is a CP, Pesetsky 2016). The repairs in question arguably violate strict cyclicity. **g)** Repair-driven pied-piping (Heck 2008, 2009) and second cycle Agree (Béjar & Řezáč 2009) apply to fix island violations and to satisfy unvalued probes. They may incur violations of a restriction against feature propagation. **h)** Repair-driven index-manipulation helps to avoid PRINCIPLE C violations (Fischer 2002). This type of repair arguably violates some faithfulness constraint.

Other types of repairs and further criteria to classify them are likely to be found.

2.3.2 Cyclic reformulation of parallel analyses

Q_2) Is it possible to (re)formulate (existing parallel, non-cyclic) analyses of repair phenomena in a serial, cyclic manner? If so, **Q_3)** what are the cyclic domains of optimization that can be assumed for the cyclic analyses in question? **Q_4)** Are there cases that resist a straightforward analysis in terms of cyclic optimization (for instance because they appear to require global information instead of reduced, local information, as is typical for cyclic optimization analyses)? **Q_5)** What is the theoretical/ conceptual prize that has to be payed if a cyclic analysis is to be enforced? These are questions that guide the second phase of the investigation. Given a particular parallel analysis, it is not a priori obvious what the answers to these questions look like.

To illustrate, consider the case of English *do*-support in the context of negation, as analyzed in Grimshaw (1997). In what follows, a fragment of this analysis is given that involves five constraints, here enumerated according to their relative ranking: i) LEXICAL ECONOMY bans movement of lexical heads; ii) CASE demands that an argument bearing nominative must occupy the specifier of a finite verb; iii) OBLIGATORY HEAD requires head positions to be overtly realized; iv) SUBJECT demands that the highest A-specifier must be filled by a (nominative) argument (where SpecV, SpecNeg and SpecT all count as A-specifiers); v) FULL INTERPRETATION militates against the insertion of expletive elements (with *do* counting as a verbal expletive). As illustrated in tableau T_1, this set of constraints allows to derive the obligatory and exceptional use of *do*-support in the context of negation in English under parallel optimization (witness *Mary did not leave* vs. **Not Mary left*, **Mary not left*, **Mary left not*, etc.)

T_1: Negation and do-Support; parallel optimization in Grimshaw (1997)

	LEX-ECON	CASE	OB-HEAD	SUB-JECT	FULL-INT
K_1: $[_{NegP}$ Neg $[_{VP}$ NP_1 V]]				*!	
K_2: $[_{NegP}$ NP_1 Neg $[_{VP}$ t_1 V]]		*!			
K_3: $[_{TP}$ NP_1 – $[_{NegP}$ Neg $[_{VP}$ t_1 V]]]		*!	*		
K_4: $[_{TP}$ NP_1 V_2 $[_{NegP}$ Neg $[_{VP}$ t_1 t_2]]]	*!				
☞K_5: $[_{TP}$ NP_1 did$_2$ $[_{NegP}$ Neg $[_{VP}$ t_1 V]]]					*

Suppose now that we wanted to recast this analysis in terms of cyclic optimization under the hypothesis that every phrase is a cyclic domain. To this end, assume, following Grimshaw (1997), that Merge of T is optional, and that candidates that Merge T compete with candidates that don't. (Merge of the verb, its arguments, and the negation is obligatory as the meanings of these elements underlie the definition of the candidate set). This correctly allows to generate as optimal the empirically attested output candidate K_5 from T_1: The competition on the NegP-cycle involves candidates $K_{1,2}$ from T_1, with K_1 being optimal, thus figuring as input for the TP-cycle; the competition on the TP-cycle consists of the candidates $K_{1,3-5}$ from T_1, resulting in K_5 as the optimal output. Next suppose that every derivational step constitutes a cyclic domain. As it turns out, this leads to a problem: The candidate that merges T with NegP but leaves the optimal NegP-output from the previous cycle unchanged (K_3 in T_2) now necessarily violates OBLIGATORY HEAD, thus losing against candidate K_1, which leaves NegP as it is (without merging T), which only violates SUBJECT. This falsely generates **Not Mary left* as optimal.

T_2: Negation and do-Support; cyclic stepwise optimization

Input: $[_{NegP}$ Neg $[_{VP}$ NP_1 V]]	LEX-ECON	CASE	OB-HEAD	SUB-JECT	FULL-INT
☞K_1: $[_{NegP}$ Neg $[_{VP}$ NP_1 V]]				*!	
K_2: $[_{NegP}$ NP_1 Neg $[_{VP}$ t_1 V]]		*!			
K_3: $[_{TP}$ T $[_{NegP}$ Neg $[_{VP}$ NP_1 V]]]			*!		

The problem is that Merge of T can only avoid a violation of SUBJECT (placing the subject in SpecT) while at the same time fulfilling OBLIGATORY HEAD (by filling T with *do*) if an output candidate can deviate from the input by applying more than one operation (Merge of T, *do*-insertion, and movement to SpecT), which is exactly what is not allowed under the concept of stepwise cyclic optimization. The attempt to solve this problem by assuming that leaving T unmerged violates some hitherto unmentioned high ranked constraint fails because now T is also merged in contexts without negation, thus leading to the generation of optimal outputs of the type **Mary did leave* (with non-emphatic *do*). A way out, it seems, would be to stipulate that T is only merged in the context of negation (due to some high ranked constraint; this is roughly the first solution to the above problem that is proposed in Müller 2020, 13-17). On the next cycle, OBLIGATORY HEAD is then satisfied by inserting *do*, followed by movement to SpecT, satisfying SUBJECT on the last cycle. This workaround, however, loses some of the elegance of Grimshaw's original analysis, where the presence of a higher head follows from the independently motivated constraint SUBJECT. A second solution, which makes the presence of T follow from CASE, and which is based on versions of SUBJECT and CASE that involve implicational relations between input and output ("two-level markedness constraints"), is suggested in Müller (2020, 17-19).

A repair that resists a straightforward local cyclic analysis (and therefore provides potential evidence against hypotheses H_2 and H_4) involves the insertion of a resumptive pronoun in the base position of an Ā-movement chain that crosses an island (see Pesetsky 1998, Bayer & Salzmann 2013 for parallel OT-analyses). The stumbling block here lies in the fact that the insertion of the resumptive pronoun applies very early in the derivation while the island that ultimately justifies resumption may be arbitrarily far away from the pronoun (Heck & Müller 2000a, Müller 2015). This problem is exacerbated in theories in which the derivation repeatedly loses information about more deeply embedded parts of the representation (i.e., also the part containing the resumptive pronoun), as is the case in the theory of phases of Chomsky (2000, 2001). A possible way to reconcile resumption as a repair with local, cyclic optimization (and also phase theory) is by a) allowing for resumption to apply freely, and b) raising the information about the presence of a resumptive pronoun up to the node that constitutes the island, where resumption can be licensed. This idea may be realized, for instance, by assuming that the use of a resumptive pronoun leads to insertion of a feature [$*\varrho*$] on the operator (the Ā-moved element) associated with the pronoun. Crucially, [$*\varrho*$] is defective (indicated by the asterisk notation) in the sense that it needs to be eliminated. This exclusively happens when the operator crosses an island. If no island is encountered, the derivation crashes. The presence of [$*\varrho*$], in turn, may even trigger morphological reflexes in some cases (cf. the notorious agreement patterns with complementizers in Irish, which differ depending on the presence or absence of a resumptive pronoun, McCloskey 1979, 2002). Such an approach looks potentially interesting also because it may be used to model last resort effects in MP (see section 2.3.4.3).

2.3.3 Arguments for cyclic optimization

Ultimately, the hypothesis of cyclic optimization (as opposed to parallel optimization) must be based on empirical grounds. This leads to the question **Q**$_6$**)**: What kind of arguments in favor of cyclic (in particular as opposed to parallel) optimization can be given?

By now, the most familiar (and presumably the most powerful) argument that can be found in the literature rests on the idea that a derivation that involves cyclic optimization may remain at a local optimum due to the reduced contextual information available at some designated point of the derivation (as is characteristic for any cyclic theory). This contrasts with a derivation allowing for parallel optimization, which has access to global information. The global optimum, which is predicted by harmonic parallelism, simply cannot be reached in the cyclic approach (a property sometimes referred to as "myopia" in the literature, see, e.g., Kimper 2012) and, importantly, is empirically not attested. Abstract patterns and concrete examples of this argument are sketched in sections 2.3.3.1 and 2.3.3.2 below.

To anticipate the discussion to come, one can identify two different sub-types of this argument, both of which are essentially based on Kiparsky's (1973) notion of opacity (see also Chomsky 1975). In terms of a rule-based theory, if a rule A creates the context of application for a rule B (and B therefore applies, too), then A is said to *feed* B. If A destroys the context of application of B (and B therefore cannot apply), then A is said to *bleed* B. These two rule interactions are transparent because the output faithfully reflects the application/ non-application of B. But there are also opaque types of rule interaction. If A is expected to feed B, but B actually does not apply (although A does), then A is said to *counter-feed* B; and if A is expected to bleed B, but B applies nevertheless (although A applies, too), then A is said to *counter-bleed* B. In both cases, the output does not reflect the expectations, given one's knowledge about the functioning of the individual rules. Therefore, the interaction is called opaque. The notion of opacity can be transferred to constraint based cyclic OT-analyses. A constraint that favors/ disfavors a repair O_R only becomes relevant at some later cycle of optimization. However, at some earlier cycle, another constraint that disfavors/ favors O_R has already determined that O_R must not/ must apply. And, crucially, the decision made on the earlier cycle is irreversible at a later one. As mentioned, it turns out (see sections 2.3.3.1 and 2.3.3.2) that many of the existing arguments in the literature for cyclic optimization are based on opacity (more concretely: counter-feeding), although they are not presented as such in the original works. Perhaps interestingly, arguments based on counter-bleeding are hardly attested.

A third type of argument involves a situation where the parallel, non-cyclic approach, generates too many or too few winners. In the first case, parallel Harmony Evaluation does not uniquely determine an optimal output but rather defines a class of winners, each of which being the result of the repair applying in a different cyclic domain ("too many winners"). Since in a cyclic approach the repair may exclusively apply within the domain that is defined by the current cycle (and since the repair must apply as early as possible, and only once), it is usually the case that only a single optimal output is generated, empirically often the correct result. In the second case, the parallel approach singles out one particular candidate K as optimal because the overall representation it evaluates contains a structural property P that uniquely favors K ("too few winners"). Under a cyclic approach, in contrast, it is possible to generate other winners alongside K if the derivation bifurcates at an early cycle where P is not yet given. This may happen if at least one of the derivations resulting from the bifurcation generates an intermediate representation that ultimately cannot make use of P, thus leading to an alternative optimal output K′. These two sub-types of arguments are sketched in section 2.3.3.3.

The leading questions in this phase of the project then are the following. **Q$_{6-a}$)** Can plausible arguments based on counter-bleeding be constructed that make use of the notion of repair? **Q$_{6-b}$)** What other types of empirical arguments for cyclic optimization can be found? **Q$_{6-c}$)** What size of cyclic domains are the arguments based on (cf. Q$_3$)? **Q$_{6-d}$)** Is there any correlation between the type of repair (see section 2.3.1) and the type of analysis? **Q$_{6-e}$)** What kind of arguments against a cyclic approach can be found? (For instance, the empirical facts may suggest that a particular repair must have access to global information; cf. also Q$_4$, section 2.3.2).

2.3.3.1 Counter-feeding opacity There are contexts where a repair operation O$_R$ does not apply although one might expect it to when looking at the surface representation. The explanation for this under a cyclic optimization approach is as follows. There is a (structure building) operation O$_S$ that creates the context of application for O$_R$. Thus, O$_S$ is expected to feed O$_R$ when, in fact, it does not. This can be modelled under the cyclic approach if O$_S$ applies at a cycle σ_m that properly contains the cycle σ_n at which O$_R$ would have to apply. In such a case, the context that, under a given ranking, favors a candidate K that realizes O$_R$ comes too late, i.e., the winner K′ does not exhibit the repair: counter-feeding. (In principle, in such a case K′ may even be the "empty output" or "null parse", see Prince & Smolensky 1993, thus leading to a "crash" of the derivation, see Heck & Müller 2003.) Crucially, application of O$_R$ within σ_n at σ_m is barred due to the STRICT CYCLE CONDITION (SCC, Chomsky 1973, 1995, 2008), as it would exclusively affect a cyclic domain (σ_n) properly embedded within another cyclic domain (σ_m). In contrast, under a parallel approach, where there is only one cycle, the context favoring candidate K is given immediately, which means that K will win and counter-feeding cannot be derived. Instances of this type of argument are presented in Heck & Müller (2000a,b, 2003, 2007, 2016).

In Heck and Müller (2003), *wh*-movement may apply as a repair for two purposes: a) To enable a *wh*-phrase to escape an impenetrable locality domain (defined by Chomsky's 2001 PHASE IMPENETRABILITY CONDITION, PIC) by successive-cyclic movement; this happens to satisfy a constraint called PHASE BALANCE (PB; in a nutshell, this constraint requires that phrases that are needed for feature checking at later points of the derivation to move the edge of the actual phase in order to remain PIC-accessible). b) To enable a *wh*-phrase to escape an ellipsis site, satisfying a high ranked constraint that militates against the unrecoverable loss of information by deletion. As usual, applying the repair comes at a certain cost, namely the violation of a (relatively low ranked) constraint against movement that is non-feature driven (violating LAST RESORT). Now, if repair-driven successive cyclic movement is banned for independent reasons (because PB is vacuously satisfied), and if the head H$_E$ triggering the ellipsis is merged in a cyclic domain (phase) that is higher than the cyclic domain that introduces the *wh*-phrase (an embedded phase), then H$_E$ comes too late to feed repair-driven movement.

Concretely, movement of a second, third, etc. *wh*-phrase WH$_i$ to SpecC, as it appears to show up in multiple sluicing constructions even in the non-multiple *wh*-movement language German, is analyzed as a repair that applies in order to avoid unrecoverable deletion of WH$_i$ (witness (1-a,b)).

(1) Jeder hat irgendwas gegessen, aber ich erinnere mich nicht. . .
"Everyone ate something, but I don't remember . . ."
   a. . . . wer was ~~gegessen hat~~.
      '. . . who ate what.'
   b. *. . . wer ~~was gegessen hat~~.

The observation that is central for Heck and Müller's (2003) argument is that multiple sluicing requires all sluiced *wh*-phrases to be merged as clause mates:

(2) a. Hans hat behauptet, dass jeder irgendetwas gegessen hat, aber ich weiß nicht mehr ...
... wer was ~~Hans behauptet hat, [$_{CP_1}$ dass gegessen hat~~].
'Hans claimed that everyone ate something, but I don't remember who Hans claimed ate what.'

b. *Jeder hat behauptet, dass Hans irgendetwas gegessen hat, aber ich weiß nicht mehr ...
... wer was ~~behauptet hat, [$_{CP_1}$ dass Hans gegessen hat~~].
'Everyone claimed that Hans ate something, but I don't remember who claimed that Hans ate what.'

In the cyclic analysis, this restriction can be derived since repair-driven successive-cyclic *wh*-movement of the lower *wh*-phrase *was* out of the embedded clause CP$_1$ in (2-a,b) is blocked (PB is satisfied by the additional *wh*-phrase in the numeration); moreover, repair-driven *wh*-movement of *was* in order to escape the ellipsis site is also blocked (by LAST RESORT) because the ellipsis trigger H$_E$ (the matrix C-head) is not part of the structure when this movement is supposed to happen. Later, when H$_E$ is introduced, the interaction of the SCC and PIC block extraction of *was* out of CP$_1$. Consequently, any *wh*-phrase that is embedded in a lower phase (such as *was* in the example above) will be trapped under the cyclic approach, resulting in a counter-feeding relation. All things equal, a parallel analysis cannot derive this because the information about the presence of H$_E$ is accessible throughout the whole (single) Harmony Evaluation. This means that the output candidate that applies repair-driven movement in order to escape the ellipsis site can successfully avoid violations of recoverability, PIC, and SCC, only incurring a non-fatal violation of LAST RESORT. Thus, long *wh*-movement of a lower *wh*-phrase in a multiple sluicing construction is predicted to be grammatical, contrary to fact.

2.3.3.2 Counter-bleeding opacity In principle, arguments in favor of cyclic optimization (and against parallel optimization) that are based on counter-bleeding should exist, too. In such a scenario one expects, when looking at the surface representation, a repair O$_R$ to not have applied, contrary to fact. The explanation in an approach in terms of cyclic optimization is straightforward: There is a (structure building) operation O$_S$ that destroys the context of application for O$_R$. The fact that O$_R$ has applied nevertheless follows under cyclic optimization if O$_R$ applies at some cycle σ_n, when the context that favors the candidate K, which realizes O$_R$, is still given. O$_S$, in contrast, applies at σ_m, a cycle that properly embeds σ_n, which is too late to bleed the winner K. Again, a parallel approach would face a problem when confronted with this state of affairs: the candidate K that realizes O$_R$ and the candidate K′ that does not are part of the same competition. Since the context that favors K is not given the costs of the repair do not pay off, leaving K′ as the winner.

Such cases may be harder to recognize simply because the over-application of O$_R$ (i.e., its unexpected application in surface environments that do not to favor it) potentially masks its nature as a repair. A repair only applies when this is forced in particular environments but is blocked otherwise (the general case). In contrast, over-application describes a state of affairs where some operation applies more often than expected, i.e., even when it should be blocked. Yet, if cyclic optimization is the right approach, then such cases should exist. This is not reflected in the analyses that are available to date. Practically all the opacity-based arguments put forward in the literature in favor of cyclic optimization that I am aware of involve counter-*feeding*. Note that there are good arguments for both cyclicity and for counter-bleeding relations in syntax. First, successive cyclic movement and SCC-effects both suggest the existence of cyclic domains in syntax (Chomsky 1973, Perlmutter & Soames 1979). Second, remnant movement (Besten & Webelhuth 1987, Müller 1998) or reconstruction for Principle A (Riemsdijk & Williams 1981, Barss 1986) are clear instances of syntactic counter-bleeding: in the first case, what looks like illicit downward movement out of an already moved category appears to be possible; in the second case, anaphor binding is possible despite the lack of surface c-command. Against this background, it would be very surprising if it turned out that convincing arguments for a cyclic optimization approach to repairs based on counter-bleeding are hard to come by.

The only potential instance of such an argument that I could find so far is provided by the resourceful proposal made in Fischer (2002). In this analysis, a PRINCIPLE C violation can be repaired at a low cycle (vP in Fischer's analysis) by changing the referential index of a pronoun such that it no longer binds a c-commanded R-expression. Some movement operation that applies at a higher cycle (targeting SpecC) may then displace the category that contains the (originally offending, co-referring) R-expression thereby removing it from the c-command domain of the pronoun. Thus, when looking at the surface, it appears that this displacement should have bled the repair, contrary to fact: Pronoun and R-expression must not bear the same index, despite the displacement (counter-bleeding).

Fischer's (2002) analysis explains why Ā-movement of a category containing an R-expression sometimes cannot bleed a PRINCIPLE C violation (or, more correctly, a PRINCIPLE B violation, see below), as observed by Lebeaux (1988), see (3-a). At the same time, it explains why a PRINCIPLE C violation *can* sometimes be avoided, thus bleeding modification of the index (the repair), see (3-b).

(3) a. *Which picture of John$_i$ did he$_i$ like?
    b. Which claim that John$_i$ made did he$_i$ later deny?

The idea is that (3-a) involves a violation of PRINCIPLE B at the vP-cycle (in Fischer 2002, PRINCIPLE B subsumes pronouns and R-expressions, deviating from Chomsky 1981; i.e., binding of *John* by *he* in (3-a) violates both Principle C and B). This forces a modification of the index. In contrast, (3-b) only violates PRINCIPLE C (due to the depth of embedding of the R-expression within the object), which is less important. Therefore, a change of the index can be avoided. (A case such as **He$_i$ denied the claim that John$_i$ later made* is blocked by a candidate related to it that involves Ā-movement of the object.) At the CP-cycle, when the object undergoes *wh*-movement thus removing the R-expression from the c-command of the subject the index has already been changed in (3-a) (counter-bleeding). Interestingly, Fischer's account derives the contrast between (3-a,b) without making the assumption that adjuncts can avoid a PRINCIPLE C violation (see (3-b)) by being merged counter-cyclically (Lebeaux 1988, 1990, Chomsky 1995, and others), in contrast to arguments (see (3-a)). This alternative proposal does not only encounter the problem that counter-cyclic application of Merge violates the SCC, but also faces the particular complication that cases can be found where even arguments do not exhibit counter-bleeding of PRINCIPLE C in the context of *wh*-movement (as observed by Lasnik 1998, Safir 1999):

(4) Which piece of evidence that John$_i$ was guilty did he$_i$ successfully refute?

The important point to acknowledge here is that the same idea of analysis cannot be pursued against the background of parallel optimization: When the two relevant candidates, the one that changes the index and the other that does not, are surface competitors in a context where the R-expression is not c-commanded by the pronoun, then the candidate that does not change the index will always win: Since movement to SpecC destroys the PRINCIPLE C inducing configuration, the additional costs of changing the referential index on the pronoun are *always* avoided when such movement applies, irrespective of depth of embedding of the R-expression (which is empirically false, recall the *picture*-example (3-a)).

However, there is a caveat that makes Fischer's analysis a less appropriate example in the context of a discussion of repairs. Namely, the output candidate that blocks (3-a) (by changing the referential index on the pronoun) can also arise as optimal from another competition when its subject pronoun bears an index that differs from the index of the R-expression as a lexical property. As a consequence, Fischer's analysis can be recast in such a way that it does not involve any repair in the technical sense assumed here. (In such a revised theory, the candidate blocking (3-a) could be the empty output.) Although even under this revised analysis there still is an argument in favor of cyclic optimization (as opposed to parallel optimization), the argument does no longer involve the notion of a repair.

2.3.3.3 Too many/ few winners There are a few cases where the argument for cyclic optimization is not based on opacity. In one case, a competing parallel approach generates too many winners. Müller (2000a) analyzes Wackernagel movement of weak pronouns in German as an instance of repair-driven movement. In this analysis, the fact that the Wackernagel landing site is not the edge of TP or CP (but the edge of vP) follows from cyclicity because Specv is the first possible landing site, and the repair has to apply instantaneously, i.e., within the cyclic domain where it arises. All things equal, a parallel approach would falsely allow for Wackernagel movement to end up in SpecT or SpecC. Müller (2000c) proposes to rephrase Kayne's (1998) remnant VP-movement analysis of negative preposing in English in terms of repair-driven movement. Here, the argument for the cyclic approach rests on the observation that a non-cyclic analysis predicts that, alongside remnant VP-fronting to (an outer) SpecNeg, verb-movement to T (empirically problematic for independent reasons, Emonds 1976, Pollock 1989) should also be an option to restore the pre-movement word order, thus repairing the damage generated by negative preposing. The cyclic approach excludes verb movement to T because the repair must apply as early as possible, i.e., at the NegP-cycle already. In a similar vein, Sappir (2011) analyzes dative possessor raising in Hebrew as repair-driven movement to SpecV. Again, the fact that such raising does not target a higher position follows from the cyclic nature of the repair.

A potential case where the parallel approach generates too few winners is instantiated by the analysis of partial *wh*-movement in Bahasa Melayu by Fanselow & Ćavar (2001). *Wh*-phrases in Bahasa Melayu may optionally be spelled-out in an intermediate SpecC-position instead of their scope position. Fanselow & Ćavar (2001) propose that the crucial point in the derivation that determines the ultimate spell-out position of a *wh*-phrase WH is one where WH has just moved from an intermediate SpecC-position to an intermediate Specv-position (i.e., successive-cyclic movement from phase edge to phase edge). At this point, it has to be decided whether WH is spelled out in SpecC or in Specv. The optionality of partial *wh*-movement (spell-out in an intermediate non-scope SpecC-position) versus full *wh*-movement (spell-out in the scope SpecC-position) arises due to a tie between two conflicting constraints, one (PARSE SCOPE) requiring WH to be spelled-out as close to its scope position as possible (i.e. Specv), the other (WH-IN-SPEC) demanding it to be spelled-out in SpecC. If the latter option is chosen, then WH is realized in the intermediate non-scope SpecC-position. If the former is chosen, it is deleted in the intermediate SpecC, but it will ultimately be spelled out in a higher SpecC-position (scope or non-scope). Under a parallel approach (provided all other things remain equal) the optionality between partial and full *wh*-movement breaks down because spell-out of WH in an intermediate SpecC cannot be derived. The problem is that the two constraints that act antagonistically in the cyclic model, where the choice is to be made between spell-out in Specv and SpecC, now consistently pull into the same direction, namely towards realizing the *wh*-phrase in its scope position. Since the candidate that spells out the *wh*-phrase in its scope position is always present under a parallel model of Harmony Evaluation, this will be the (only) optimal output. Hence, there are too few winners. It should be added that, in order for Fanselow and Ćavar's (2001) analysis to bear relevance on the issue of syntactic repairs, some reconceptualization of the theory of copy deletion is called for such that, generally, all copies are deleted but as a repair one copy is retained in order to avoid unrecoverable loss of information.

2.3.4 Repairs in the Minimalist Program

In the preceding sections, I elaborated on what existing arguments for cyclic optimization look like. I now turn to the problem of analyzing repairs in MP. The main question to be pursued in this phase of the project is the following. **Q_7)** Can analyses that are formulated against the background of MP and that make use of the notion of repair/last resort be reformulated in such a way that the underlying intuition of a repair is preserved but without invoking the notions of violable and ranked constraints?

Usually, the notion of repair is left more or less implicit in MP-analyses. The most detailed proposals invoke preference principles of some kind. This is exemplarily reflected in the following quote.

> "Since Chomsky (1977) it has been widely assumed that the rule that generates resumptive pronouns [...] constitutes a last resort operation designed to rescue an otherwise illicit structure [...] In more recent work, Chomsky (1991) attempts to explicitly characterize last resort operations by relating them to principles of economy that impose a markedness hierarchy on grammatical operations." (Shlonsky 1992, 447)

However, a clear theory of such preference principles is still lacking. Thus, the answer to Q_7 is far from obvious, and it may well be the case that different types of repairs (which can be treated in a uniform manner in OT) require a rather heterogeneous treatment in MP. In what follows, different potential lines of approaching the problem are sketched.

2.3.4.1 Goal-driven rules Starting with an example from the non-OT literature on phonology, Frampton (2009, 90-94) uses what he calls "goal-driven" rules (GDRs; "defect-driven" rules in Frampton 2008) in order to deal with repair-like situations in a theory that does not acknowledge ranked and violable constraints. Extending Chomsky and Halle's (1968) notation for a transformational rule r in (5-a), Frampton defines the notion of a GDR as in (5-b).

(5) a. $\alpha \xrightarrow{r} \beta$: r can apply to α to produce β.
b. $\alpha \xrightarrow{g\,::\,r} \beta$ if α does not satisfy g, $\alpha \xrightarrow{r} \beta$, and β does satisfy g.

The idea is that a GDR applies to a representation α that is supposed to serve as the input to some "regular" rule R (reduplication in Frampton 2009). Its purpose is to repair a representation α that exhibits a defect (α does not satisfy the goal g), which prevents it from figuring as an appropriate input for R.

To illustrate, Frampton (2009) proposes that reduplication involves "juncture insertion" (JI). Junctures are (pairs of) boundary symbols ("[" and "]") that mark the (partial) string of the base that is supposed to undergo reduplication ("transcription" in Frampton's 2009 terms). Other symbols that are inserted ("⟨", "⟩") mark elements that are exempt from being transcribed. JI often inserts only one symbol of a pair, leaving the insertion of the second symbol to be handled by default rules ("closure"). This helps to simplify the formulation of JI. Yet, in some cases, a uniform, simple formulation of JI appears not to be straightforward. For instance, reduplication in Chukchee comprises pairs as the following: *nute* ⇝ *nute-**nut***; *inu* ⇝ *inu-**in***; *jilʔe* ⇝ *jilʔe-**jil***. A derivation that is based on JI only (the rules of which are not given here) generates the ill-formed output **jilʔe-**ji***, as illustrated in (6). Therefore, a goal-driven rule is needed that adjusts the input for transcription by shifting the symbol "⟨" one segmental position to the right. The goal is to create a bimoraic reduplicant, see (7).

(6)

Input:	jilʔe
Juncture Insertion:	[ji⟨lʔe
Default Closure:	[ji⟨lʔe⟩]
Transcription:	[ji⟨lʔe⟩]-ji

(7)

Input:	jilʔe
Juncture Insertion:	[ji⟨lʔe
Default Closure:	[ji⟨lʔe⟩]
Goal-Driven Rule:	[jil⟨ʔe⟩]
Transcription:	[jil⟨ʔe⟩]-jil

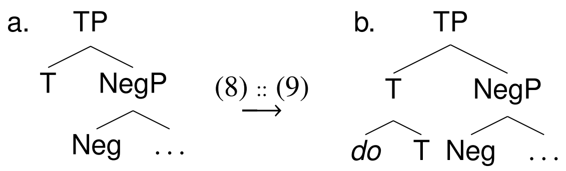
To ensure the last resort nature of the repair, an analysis in terms of GDR requires that the derivation first generates the very defect that triggers the GDR. In (7), JI and default closure create an input that does not contain a bimoraic base for reduplication, hence fails to satisfy the goal. The GDR only applies if this defect is to be fixed.

If one wants to analyze a syntactic repair, say *do*-support, in terms of a GDR, then one has to ensure that the derivation first generates a defective representation for there to be a trigger for the GDR (thus accounting for its last resort property). Arguably, in the case of *do*-support the presence of negation in English leads to such defectivity (in the absence of an auxiliary). Thus, suppose for expository reasons, as is often done, a) that English exhibits syntactic T-lowering to the main verb (again, if there is no auxiliary), where lowering leaves behind a copy, just as raising does, and b-i) that the features on T (tense and agreement) need to be spelled out, b-ii) that due to their affixal nature they can only be spelled out if they are sister to a lexical head that binds them, and b-iii) that always the highest copy (of a [tense,agr] chain) that fulfills the previous conditions undergoes spell-out. Finally, assume that English involves a condition that every head bearing [+tense] must (at spell-out) have a sister that bears [+V]. This latter condition will serve as the goal of the GDR, see (8). The GDR itself is given in (9).

(8) Goal for *do*-support:
At spell-out, every X bearing [+tense] must have a sister Y bearing [+V].

(9) *Do*-support:
$[_{\text{XP}}$ X[+tense] ...] ⟶ $[_{\text{XP}}$ $[_{\text{X}}$ *do* X[+tense]] ...]

Consider first a derivation where T merges directly with VP (without an intervening NegP). After T-lowering to V, both copies of T are sisters to a [+V]-category, but only the lower copy is sister to a lexical head (the main verb itself) while the sister of the higher T-copy is a VP. Therefore, only the lower copy qualifies as a binder for the affixal features of T, and spell-out accordingly targets the lower copy of T (witness *Mary always leave-s*). In contrast, if a Neg-phrase intervenes between T and VP, the higher copy of T (after T-lowering) does not satisfy the goal in (8). Therefore, the GDR in (9) applies, merging a verbal expletive as a sister to the higher T-head.

(10)


Both copies of T in (10-b) are sisters of a head bearing [+V]. Accordingly, spell-out targets the higher copy (resulting in a configuration with inflected *do*: *Mary doe-s not leave*). The account also carries over to instances of *do*-support as it shows up in non-embedded non-subject *wh*-questions in English. This is also captured by the OT-analysis in Grimshaw (1997). (Potential complications may emerge when the *wh*-movement context overlaps with the context of negation. Also note that other generalizations about *do*-support are possible, see section 2.3.4.2.)

However, the approach also raises some questions. Perhaps the most pressing problem is that a GDR of the form in (9) is a transformational rule. But such rules are not part of MP proper. Thus, something has to be said about how exactly GDRs are to be transferred into MP (see section 2.3.4.3).

2.3.4.2 Stratification Before I turn to a translation of GDRs into MP (2.3.4.3), let me briefly address an alternative way to account for the last resort nature of repairs. The idea is to locate the repair operation O_R on a stratum that follows the stratum containing a regular operation O′ that may destroy the context of application of O_R. It then follows that O_R only applies if O′ does not.

This view is helpful if O_R is *do*-support (O′ being T-lowering; cf. Chomsky 1957). As is known, *do*-support in English also shows up in the contexts of VP-ellipsis and VP-fronting. One may thus argue that negation forms a natural class with these two contexts (rather than with the context of non-subject *wh*-movement). Then, the correct generalization is that *do*-support applies if the features of T remain bare because they cannot combine with the verb via lowering (either negation or the subject block lowering, or the target of lowering has been removed by ellipsis or fronting, see Adger 2003). The generalization is difficult to account for if *do*-support is syntactic. For instance, *do*-support applies on the TP-cycle while VP-fronting (which leads to the non-application of T-lowering) arguably applies later, namely at the CP-cycle. But if *do*-support and T-lowering apply post-syntactically (Bobaljik 1994, 2002), then the above sketched account becomes possible if one assumes a stratification of post-syntactic operations such that T-lowering precedes *do*-support (cf. Arregi & Nevins 2012; again, see Chomsky 1957).

The approach does not require constraint ranking (although the OT-typical constraint ranking is emulated in terms of ordering of operations via stratification) and no violability of constraints. Moreover, the intuition underlying the notion of repair is also preserved. The approach appears to be applicable to some cases of repair by lexical insertion (*do*-support, default inflection) and repair of locality/ anti-locality (e.g., resumption, which is akin to lexical insertion). However, there are also cases of lexical insertion that seem less amenable to the idea that a repair applies in the morphology/ at PF: R-pronouns (in Dutch or German), for instance, presumably must be present in the syntax proper in order to realize thematic roles, and the expletive pre-field *es* of German does not appear to be inserted for phonological reasons (for instance, pre-field *es* typically triggers V2, which is also triggered by phonetically (but not syntactically) empty pre-fields, see intermediate SpecC-traces in successive-cyclic movement from V2-clauses, V2 with phonetically empty interrogative operators, etc.). Moreover, such an approach does not appear to be suited to account for repair-driven movement, repair-driven copying in the numeration, or repair-driven violations of the strict cycle condition because in these cases the repair-operation applies very early in the derivation (i.e., in the syntax or even pre-syntactically). Therefore, it seems fair to say that a stratification approach of this kind does not offer a general solution to the problem at hand.

2.3.4.3 Defective features In this section, I briefly sketch a possible way of integrating the concept of goal-driven rules into MP without reference to transformational rules, i.e., by only making use of the theoretical vocabulary that is common in MP (in essence the notion of "feature checking"). As an illustration, the case of repair-driven movement is chosen. As mentioned in section 2.3.3.1, repair-driven movement (according to the OT-analysis in Heck & Müller 2000a) is an instance of movement that applies without feature checking (thus violating LAST RESORT) in order to satisfy a high-ranked requirement. In some cases, repair-driven movement can be motivated by the need to escape an ellipsis site (e.g. multiple *wh*-movement in sluicing contexts), thereby avoiding the unrecoverable loss of information (deletion of a *wh*-phrase).

This said, a scheme for translating an OT-analysis of repair-driven movement into MP by a GDR-like mechanism may look as in (11):

(11)

	Optimality Theory		*Minimalist Program*
1.	There is a (partial) ranking of violable constraints $B_H \gg B_L$.	1.	There are no violable ranked constraints.
2.	B_L encodes the costs of the repair O_R, thereby ensuring that O_R applies as a last resort.	2.	The repair operation O_R as such applies freely but generates a feature that requires subsequent application of an operation O_S to prevent the derivation from crashing.
3.	B_H enforces application of O_R.	3.	O_S is only available in particular contexts, which indirectly characterizes the last resort of O_R.

The left-hand side presents the logic of a repair-analysis in OT. B_L (here: LAST RESORT) is violated by any candidate that involves the repair O_R (some type of movement), thus blocking the free application of O_R. B_H (here: RECOVERABILITY OF DELETION) is the constraint that enforces O_R to apply: Violating B_L is still better than violating B_H. The right-hand side column sketches the corresponding analysis in MP. Since LAST RESORT is violated by non-feature driven movement, and since MP does not allow for violable constraints, one may reanalyze repair-driven movement as movement that becomes possible by the insertion of "edge features" (EFs). (Alternatively, one may conclude that LAST RESORT cannot be part of the theory, Chomsky et al. 2019). EF-insertion, by assumption, is free. Thus, the application of O_R per se does not violate any constraint of the grammar. Still, in order to capture its last resort property it has to be ensured that O_R only applies in particular contexts. The idea is that O_R generates a feature [$*\varrho*$] (cf. section 2.3.2), possibly alongside the EF on the head that provides the landing side for repair-driven movement. (The insertion of both EF and [$*\varrho*$] is not compatible with the INCLUSIVENESS CONDITION of Chomsky 1995.) In cases where repair-driven movement applies in order to escape unrecoverable deletion one may hypothesize that [$*\varrho*$] is eliminated by ellipsis (following Lasnik 1999). In cases where it applies in order to balance a phase (due to PHASE BALANCE, Heck & Müller 2000b, 2003), an unbalanced phase head must be equipped by the derivation with the ability to eliminate [$*\varrho*$], perhaps by getting assigned the corresponding checking feature [ϱ]. In the scheme above, the role of the goal, which serves as the trigger in a theory invoking a GDR and thereby ensures its last resort nature, is taken over by the defective feature [$*\varrho*$]. Representations that contain [$*\varrho*$] (and which therefore have been affected by the repair operation O_R) are in need of the salvaging operation O_S. O_S, in turn, is only available in contexts that correspond to the last resort contexts of the GDR.

Note that it may be necessary to invoke another type of salvaging operation O_S for every new type of repair. But actually, something similar holds for the OT-analysis: for each case of a repair, a high ranked constraint B_H is required that enforces it. And just like the OT-approach needs to assume a low ranked constraint B_L that blocks the unmotivated application of O_R, the MP-version needs to stipulate a feature [$*\varrho*$]. Nevertheless, it can be argued that this translation scheme to repairs is less general than the OT-approach because the latter can directly handle *any type* of repair by the logic of constraint ranking. In contrast, the former requires the stipulation that different processes are appropriate to eliminate [$*\varrho*$]. Above, this was illustrated for repair-driven movement. Similarly, for a related MP-analysis of *do*-support one would have to assume that $[*\varrho*]$ is generated as a reflex to *do*-insertion and then eliminated by different processes that correspond to the different contexts of *do*-support. Furthermore, the abstractness of the hypothesized feature $[*\varrho*]$, may raise learnability issues (cf. section 2.3.2). Finally, the analysis does not address the question why a particular repair is chosen over another one, in contrast to an OT-approach. (One may wonder, e.g., why instead of getting picked up by *do*-support a stranded T in English does not get bound by some non-verbal element at the cost of violating selectional restrictions; or why an island violation is not fixed by manipulating the island itself instead of inserting a resumptive pronoun, cf. Pesetsky 2016.) In fact, it is not even clear how this question could be addressed under these assumptions to begin with. In the project, it will be investigated in how far these are serious drawbacks of the above sketched proposal, and what other approaches to repairs in MP are available.

2.3.5 Project timeline

The project's timeline is given in (12). Placeholders for the topics to be worked on are: A = Creation of a sample of repairs and set-up of a taxonomy of types of syntactic repairs; B = rephrasing of parallel analyses in terms of cyclic optimization; C = development of new cyclic analyses; D = identification of arguments for cyclic optimization; E = treatment of potential problems for cyclic optimization; F = development of a MP-analysis of repairs; G = writing of dissertation/ preparation of publications.

(12)

	Postdoc	PhD student	PI
1st year	A	A	A
2nd year	B, C	B	B, C
3rd year	D, E	F	D, E, F
4th year	G	G	G

2.4 Data handling

The project will compile a systematic taxonomy of syntactic repairs across languages based on written source material. To make this taxonomy accessible for further scientific research, it will be published as a relational database at the Clarin-D repository of Leipzig University (see the application for the coordination project for details). The database will specify the following categories (and others depending on the specific results of the taxonomy): a) Type of repair, b) language that exhibits the repair, c) sources that mention the repair, d) previous analyses of the repair, e) cyclic analysis of the repair possible (yes/no), f) lower and upper bound for the size of cyclic domains of the analysis.

2.5 Other information: Cooperation within the Research Unit

Optimal matches between clause-embedding predicates and their clausal complements (Syn🚲Sem): The project on clausal embedding is relevant in two respects to the present project. First, it investigates aspects of embedding that appear to run counter a cyclic optimization approach because they appear, at least at first sight, to require a top-down process: information that is relevant for an optimization procedure that is to be performed in an embedded cycle only becomes introduced in a higher cycle. Second, the phenomenon of coercion investigated by Syn🚲Sem may be thought of as a repair that changes features on a clause embedding predicate in response to being merged with a particular complement.

Computational aspects of cyclic optimization (Com🚲Asp): C🚲m investigates the formal properties of "extremely local optimization (Heck & Müller 2007, 2013). As this approach is also central to the present project, there is certainly potential for interaction between these two projects. For instance, one question that I am also interested in is whether the empirical effects that are attributed to cyclic optimization are really contingent on optimization as such, or whether these effects can be emulated by making other (linguistically plausible) assumptions, for instance against the background of the Minimalist Program. Such a cooperation may be carried out as part of the rotation program of the RU.

Prospects of inflectional morphology in Harmonic Serialism (Mor🚲Mor): While Mor🚲Mor project is concerned with Harmonic Serialism in morphology, it partially builds upon previous work that was conducted in the realm of syntax under the hypothesis that the cyclic domain of optimization is the derivational step (Heck & Müller 2007). Moreover, some of the phenomena investigated in Mor🚲Mor may be thought of as morphological repairs. A question that arises from this is whether (and what type of) arguments for cyclic optimization that are made in one project can be transferred to the other one.

Layers of morphosyntactic number in Eastern Sudanic (Syn🚲Mor): Part of Syn🚲Mor is concerned with the treatment of over-/ under-exponence of number in verbal agreement. It is not implausible to hypothesize that under-exponence is a case of repair: A markedness constraint against over-exponence triggers feature deletion, and there may be contexts suggesting that deletion is in fact costly (violating faithfulness). Suppose that it turns out that deletion applies only if further conditions are satisfied (e.g., if the two number probes stand in a local relation). In contexts where these further conditions are not satisfied, deletion would then be blocked by faithfulness. Speculating further that subsequent syntactic movement can lead to non-satisfaction of the conditions on deletion, one might find a counter-bleeding argument for cyclic optimization in the realm of under-exponed number-agreement. This looks like a good candidate for a cooperation in the context of the rotation program of the RU.

Prosodically determined dislocation of coordinators (Syn🚲Phon): The distinction between configurational and operational theories of prosodically determined dislocation made in Syn🚲Phon is reminiscent of the distinct approaches to repairs in terms of cyclic optimization and goal-driven rules (which, effectively, do not involve optimization proper). It might be worth to pursue this further and see whether these different paradigms can be fruitfully related. Moreover, both projects involve the notion of a repair. Insights from prosodically driven repairs may inform the present project with criteria that help to distinguish genuine syntactic repairs from others.

2.6 Descriptions of proposed investigations involving experiments on humans, human materials or animals as well as dual use research of concern not applicable

2.7 Information on scientific and financial involvement of international cooperation partners not applicable

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