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Prospects of Inflectional Morphology in Harmonic Serialism

Project description

This project pursues a cyclic, optimization-based approach to inflectional morphology that relies on Harmonic Serialism, a derivational alternative to Standard Parallel Optimality Theory. The first goal is to establish this approach as a viable alternative to current morphological theories, like Distributed Morphology or Paradigm Function Morphology; the second, more far-reaching goal is to show that it can solve some recalcitrant problems for existing theories in the areas of impoverishment, exponent drop, deponency, paradigmatic gaps, morphological movement, discontinuous bleeding, and learning algorithms for underspecification.

1 State of the art and preliminary work

Harmonic Serialism is a (proto-) cyclic version of Optimality Theory (cf. the main proposal) that has been pursued for phonology and syntax but not yet for morphology. Taking the first sketch in Müller (2020) as a starting point, the project aims at determining the prospects of an approach to inflectional morphology based on Harmonic Serialism.

Harmonic serialism (HS) has been envisaged as an alternative to Standard Parallel Optimality Theory (SPOT) from the very beginning (Prince & Smolensky (2004)), and has actively been pursued over the last decade both for phonology (McCarthy (2010, 2016), among many others) and for syntax (Heck & Müller (2013, 2016), Assmann et al. (2015), Murphy (2017); here the model is sometimes referred to as 'extremely local optimization'). In HS, generation and harmony evaluation alternate constantly: Given an initial input, a finite set of competing output candidates is generated; the outputs here differ from the input by application of at most one operation. The optimal output then forms the input for the next generation procedure, and so on; this way the overall constraint profile is gradually improved. Once improvement is not possible anymore, the derivation converges. Whereas HS is a vibrant research programme in phonology and syntax, until very recently there had basically been no work in morphology (but see Wunderlich (1997) and Caballero & Inkelas (2013) for serial affixation in Minimalist Morphology and Optimal Construction Grammar, respectively).

In Müller (2020), the outlines of a harmonic serialist approach to inflectional morphology are developed. Theoretical approaches to inflectional morphology may differ along a number of dimensions; the new harmonic serialist approach qualifies as (a) *realizational*, (b) *lexical*, (c) *Merge-based*, and (d) *pre-syntactic*. Let me briefly justify these decisions. First, the approach is *realizational* in the sense that morphological exponents do not contribute features to the word that would otherwise not be in place; in contrasting *incremental* approaches, they do. Incremental approaches face the initial difficulty of implementing the concept of underspecification as the main source of syncretism (because an underspecified exponent requires a fully specified, or at least more specified, feature matrix to be compared with, but that is not present if the exponent is solely responsible for all the relevant features), and necessitate additional assumptions if this concept is to be adopted (as in Minimalist Morphology; Wunderlich (1997)); in line with this, most current theories of inflectional morphology are realizational (e.g., Paradigm Function Morphology (Stump (2001, 2016)), Network Morphology (Corbett & Fraser (1993), Brown & Hippisley (2012)), Distributed Morphology (Halle & Marantz (1993), Noyer (1997))). Second, the approach is *lexical*, i.e., morphological exponents are assumed to exist independently in the mental lexicon, and are added to a stem (as in Distributed Morphology); in contrasting *inferential* approaches (like Paradigm Function Morphology, Network Morphology, or Anderson's (1992) Amorphous Morphology), morphological exponents do not exist as such, and inflection comes about as a consequence of rules of exponence. Here the main rationale underlying the decision is that the lexical approach arguably lends itself somewhat more easily to the stepwise, strictly derivational account that is inherent to HS; also, the formulation of the violable and ranked constraints at the heart of

the system is often much more straightforward if the constraints talk about exponents with their properties, rather than about rules that introduce them. These considerations notwithstanding, it seems clear that all cases of non-segmental morphological exponence that might initially be taken to support an inferential approach can be transferred to a lexical approach making use of abstract phonological features attributed to exponents (Wiese (1996), Trommer (2011)); this is in stark contrast to *radically* amorphematic approaches that do not envisage *any* direct association of morpho-syntactic and phonological features in exponence (Müller (2002), Carstairs-McCarthy (2008)). Third, it would seem to be uncontroversial that in the absence of strong evidence to the contrary, morphological exponence should be taken to result from general operations which are independently motivated in the grammar. This tenet is adhered to if exponence in inflectional morphology involves *structure-building via Merge* (Alexiadou & Müller (2008), Bruening (2017)), i.e., the elementary operation underlying derivations in the minimalist program (Chomsky (2001)), rather than specific *substitution transformations* applying to terminal nodes (Halle & Marantz (1993)) or entire subtrees (Ackema & Neeleman (2004), Caha (2013), De Clercq & Vanden Wyngaerd (2017)). Finally, the approach is *pre-syntactic*, not *post-syntactic*, *parallel*, or *syntax-internal*: Assuming inflectional morphology to be a proper part of syntax is incompatible with the evidence that morphology can employ both features ('morphomic' features like, e.g., inflection class features; Aronoff (1994)) and feature structures (in particular, underspecification) which have no place in syntax; also, to exclude the possibility that syntactic operations have access to the internal structure of inflected words, additional restrictions to this effect are required (Bruening (2017)). Assuming inflectional morphology to be post-syntactic (as in Distributed Morphology) addresses these issues, but is incompatible with the assumption that all structure-building operations obey the *Strict Cycle Condition*, which blocks operations from applying exclusively to embedded domains (Chomsky (1973, 1995, 2008)): Post-syntactic morphological exponence by Merge (or by insertion) is inherently counter-cyclic. As for the third alternative option (viz., parallelism, as in Paradigm Function Morphology), there would be no deep incompatibilities; the primary reason for not adopting it here is a general postulation that the Chomskyan Y-model of grammar is essentially correct.

Against this background, the approach in Müller (2020) works as follows. Initially, a *stem* A is taken from the lexicon with its *inherent* features (e.g., inflection class, gender, aspectual information). These features are always fully specified. Next, *non-inherent features* (e.g., person, number, case, tense) are added in the *numeration*. On this view, the numeration is not merely the place where lexical items are assembled prior to their use in subsequent syntactic derivations (Chomsky (2001)); it is in fact also a generative component, viz., the place where inflectional morphology takes place. The non-inherent features are also always fully specified. Together, inherent and non-inherent features on the stem provide the context for underspecified inflection markers (cf. the paradigm cell or the syntactic insertion context in other approaches). After this, triggered by high-ranked MERGE CONDITIONS (MCs) for structure-building features [•α•], [•β•], ... on a stem, inflectional exponents of type [α], [β], ... are successively merged with the stem, thereby eventually generating whole words. The morphological categories [α], [β] involved here may or may not correspond directly to syntactic categories (i.e., they can be morphomic); they are determined by *morphological arrays*, i.e., sets that collect (underspecified) exponents sharing morpho-syntactic features. Each Merge operation is required to add the new exponent at the left or right edge of the current stem, because of the *Strict Cycle Condition*; the ranking of MCs (thus, the order of Merge operations) follows the *functional sequence* of grammatical categories.

In addition to MCs, there are IDENT and MAX constraints deriving the compatibility and specificity requirements for underspecified morphological exponents (thereby implementing standard approaches to syncretism in OT; Grimshaw (2001), Trommer (2001), Stiebels (2006), Wolf (2008)); and there are alignment (and other) constraints (like $\alpha\Rightarrow$R(ight), L(eft)$\Leftarrow\beta$, $\alpha\Rightarrow\beta$) determining the order of exponents (Trommer (2001, 2008a), Ryan (2010)). Finally, the fully inflected word composed of stem and inflectional exponents is transferred to the syntax, which cannot see the internal structure generated in the morphology (a version of the *Strong Lexicalist Hypothesis*); but it can access the morpho-syntactic features associated with the stem, and carry out Agree operations (Chomsky (2001), Bruening (2017)).

As shown in Müller (2020), an approach to inflectional morphology in terms of HS offers new perspectives on some core phenomena in inflectional morphology, viz., *affix order*, *extended exponence*,

disjunctive blocking, apparently *non-local stem allomorphy*, and **ABA patterns* (Bobaljik (2012)). For instance, partially superfluous extended exponence (Caballero & Harris (2012)), where the morpho-syntactic features of two exponents in a single word stand in a proper subset relation, poses a problem for many theories of morphology because the subset exponent would seem to be globally unmotivated. In the present approach, the subset exponent can be shown to be locally optimal at an early stage of the derivation (given a high-ranked constraint called MIN(IMIZE)SAT(ISFACTION) that prefers the more general exponent); its presence is counter-bled by the more specific exponent added later. This in turn necessitates a new approach to disjunctive blocking according to which the derivation also starts with the most general exponent but then successively advances to more and more specific ones, via *removal* of earlier exponents (cf. Harbour (2003), Embick (2010), Henze & Zimmermann (2011), Arregi & Nevins (2012) for the option of such a removal, and Müller (2018) for an implementation).

Perhaps the most striking property of the new approach is that, unlike virtually all established approaches recognizing a separate morphological component of the grammar, it automatically predicts the existence of *movement* of morphological exponents in words. For instance, morphological movement will almost invariably arise when the ranking of two MCs is identical to the ranking of the respective alignment constraints: MC(α) $\gg$ MC(β) $\gg$ $\alpha\Rightarrow$R $\gg$ $\beta\Rightarrow$R: Given a high-ranked ban on prefixation, α is merged with the stem as a suffix first, β is merged as a suffix next, and α finally moves across β so as to improve the constraint profile further ($\alpha\Rightarrow$R outranks $\beta\Rightarrow$R). As argued in Müller (2020), the natural availability of morphological movement accounts for some challenging phenomena: (i) *discontinuous exponence* (two exponents are merged as one complex exponent that gets split up by movement); (ii) *phonological reflexes* (an exponent can locally trigger a phonological process on the stem before undergoing movement, giving rise to apparent non-locality of the process); (iii) *discontinuous partially superfluous extended exponence* (the more general exponent, merged closer to the stem, may show up further away than the more specific exponent as a result of movement); and (iv) seemingly *non-local stem allomorphy* (which emerges as local stem allomorphy accompanied by exponent movement).

From a more general point of view, this approach to inflectional morphology combines *cyclicity* and *optimization*. It qualifies as inherently cyclic because structure-building and other operations alternate systematically (including the option of interspersing morphological and phonological cycles; Gleim et al. (2019)), and because it identifies designated cyclic domains (the morphological array and the morphological subarray) which have to be exhausted before the derivation can move to the next cyclic domain; and it relies on optimization since it employs the standard evaluation metric of OT.

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

1. Müller, G. 2004. A Distributed Morphology approach to syncretism in Russian noun inflection. In O. Arnaudova, W. Brown, M. L. Rivero & D. Stojanovic (eds.), *Proceedings of FASL 12*, 353-373. Michigan Slavic Publications.
2. Müller, G. 2005. Syncretism and iconicity in Icelandic noun declensions: A Distributed Morphology approach. *Yearbook of Morphology* 2004, 229-271.
3. Müller, G. 2007. Extended exponence by enrichment: Argument encoding in German, Archi, and Timucua. In T. Scheffler, J. Tauberer, A. Eilam, & L. Mayol (eds.), *Proceedings of the 30th Annual Penn Linguistics Colloquium*, 253-266. PWPiL, vol. 13.1.
4. Müller, G. 2011. Syncretism without underspecification in Optimality Theory: The role of leading forms. *Word Structure* 4:1, 53-103.
5. Müller, G. 2013. Approaches to Deponency. *Language and Linguistics Compass* 7 (6), 351-369.
6. Opitz, A., S. Regel, G. Müller & A. D. Friederici. 2013. Neurophysiological evidence for morphological underspecification in German strong adjective inflection. *Language* 89:2, 231-264.
7. Keine, S. & G. Müller. 2015. Differential argument encoding by impoverishment. In I. Bornkessel-Schlesewsky, A. Malchukov, & M. Richards (eds.), *Scales and hierarchies*, 75-130.
8. Müller, G. 2015. Optimality-Theoretic Syntax. In T. Kiss & A. Alexiadou (eds.), *Syntax – theory and analysis. An international handbook*, 875-936. Berlin: De Gruyter.
9. Heck, F. & G. Müller. 2016. On accelerating and decelerating movement. From Minimalist preference principles to Harmonic Serialism. In G. Legendre, M.T. Putnam, H. de Swart & E. Zaroukian (eds.), *Optimality-Theoretic syntax, semantics, and pragmatics*, 78-110. Oxford: Oxford University Press.
10. Müller, G. 2020. *Inflectional morphology in Harmonic Serialism*. Sheffield: Equinox.

2 Objectives and work programme

2.1 Anticipated total duration of the project

48 months

2.2 Objectives

The project pursues two interrelated goals: The first goal is simply to substantiate HS as a viable approach to inflectional morphology, covering roughly the same ground as other models like Distributed Morphology or Paradigm Function Morphology. Given that HS has been successfully pursued in both phonology and syntax, successfully establishing the model as a working theory of (inflectional) morphology opens up the possibility of a single, unified approach to all form-based components of grammar, one which has the potential to reconcile the two widely adopted but seemingly incompatible approaches of minimalist syntax (Chomsky (2001)) and optimality-theoretic phonology (Prince & Smolensky (2004)) in a coherent, highly restrictive framework. The harmonic serialist approach to inflectional morphology in Müller (2020) is primarily designed to provide a basic proof of concept, by showing how some well-known phenomena (affix order, extended exponence, disjunctive blocking, non-local stem allomorphy, and *ABA patterns) can be accounted for, in sometimes straightforward but more often radically new ways, which would seem to be empirically or conceptually superior in at least some of the cases considered. However, this is clearly only the very first step: To reach this first goal, many more paradigms from many more languages need to be systematically investigated, and exponent order, disjunctive blocking and extended exponence effects derived.

The second, more far-reaching goal is to try to show that the approach can offer new and convincing solutions to some recalcitrant problems for existing morphological theories, in the areas of impoverishment (2.3.1), exponent drop (2.3.2), deponency (2.3.3), paradigmatic gaps (2.3.4), morphological movement (2.3.5), and discontinuous bleeding and learning algorithms for underspecification (2.3.6). Of course, the question arises what the properties of the harmonic serialist approach are that make it amenable to new perspectives on these phenomena where other, well-established approaches are not. The answer is that HS is unique in combining a *derivational, cyclic* approach with an *optimality-theoretic* approach to optimization. The former property implies that decisions in inflectional morphology can be *myopic* (and may ultimately give rise to *opacity* in the sense of Kiparsky (1973) and Chomsky (1975)), and that *intermediate stages of derivations* may be crucial for determining the properties of eventual output forms. The latter property makes it possible to accomodate evidence for violable and ranked constraints, like *repair* or *last resort*, *emergence of the unmarked*, *conspiracies*, *constraint simplicity*, and to some extent also *parametrization by reranking* (although it should be noted that there are a couple of fixed rankings among some constraint classes postulated in Müller (2020)).

Finally, note that the two main goals of the present project are tightly interrelated: By carrying out an analysis of some phenomenon in 2.3.1–2.3.6 on the basis of some inflectional paradigms in some language, the viability of HS for phenomena like those mentioned for the first goal will also be determined.

2.3 Work programme including proposed research methods

2.3.1 Impoverishment

Most current theories of inflectional morphology adopt designated means to systematically capture morphology/syntax mismatches, and/or to express system-wide generalizations that hold independently of the features of individual exponents. For instance, with extremely few exceptions (Corbett & Fraser (1993) on Russian), Indo-European noun inflection systems exhibit a system-wide syncretism pattern according to which nominative and accusative neuter environments cannot give rise to differences in exponence; next, there is systematic syncretism of exponents in 1. and 3. person past and plural environments in German conjugation, across all inflection classes (strong, weak, pretero-present verbs, and *sein* ('be')); similarly, exponents have to be identical with all inflection classes in 2./3. person singular preterite environments (aorist and imperfect) in Bulgarian conjugation; in Warlpiri, reflexive exponents

cannot reflect person distinctions in the plural; in the Arabic prefix conjugation, gender distinctions cannot be expressed in 1. person environments; in Yagaria (Hua), 2. person singular and 1. person plural environments always show identical exponence, in all tenses and moods; and so on. Scenarios where morphological exponence seems unable to distinguish contexts that must be distinguished in the syntax seem to be ubiquitous in rich morphological systems.

In Paradigm Function Morphology and Network Morphology, *rules of referral* (Zwicky (1985)) are adopted to account for these effects. A rule of referral states that the morphological realization of some (fully specified) set of morphosyntactic features (the syntactic environment, or paradigm cell) is identical to the morphological realization of some other (fully specified) set of morphosyntactic features, independently of what rules of exponence would predict. This covers systematic syncretism patterns, but no attempt is made to derive them from more elementary assumptions. In contrast, in Distributed Morphology these effects can be traced back to *impoverishment* (Bonet (1991), Noyer (1997, 1998), Halle & Marantz (1993, 1994), Sauerland (1996), Halle (1997), Trommer (1999), Bobaljik (2002b), Frampton (2002), Harbour (2003), Embick & Noyer (2007), Harley (2008), Arregi & Nevins (2012), Baier (2018), Keine & Müller (2020)). Impoverishment is a post-syntactic operation that deletes morpho-syntactic features in syntactic representations before morphological exponence takes place. Morphological exponence then finds an impoverished environment, and this brings about a "retreat to the general case": Since morphological exponence requires compatibility and specificity, impoverishment may lead to a scenario where the most specific exponent that would be compatible with the syntactic context fails to be compatible with the *post*-syntactic context, and a less specific exponent must be chosen.

In SPOT, essentially two kinds of implementations of impoverishment effects have been proposed. On the one hand, based on a post-syntactic approach, it is argued in Keine & Müller (2014) that syntactic structures can be subject to *feature deletion* triggered by high-ranked markedness constraints (in violation of lower-ranked MAX constraints that are sensitive to prominence scales, and derived by harmonic alignment and local conjunction, as in Aissen (2003)) prior to morphological exponence; this provides a principled account of the trigger of impoverishment, but the overall effect is identical to that derived under classical impoverishment rules. On the other hand, it has been suggested that impoverishment effects in SPOT can be traced back not to feature deletion, but to *feature inaccessibility*, which results from high-ranked markedness constraints precluding the realization of the feature(s) (Trommer (2003), Wunderlich (2004), Don & Blom (2006)). In principle, both kinds of approaches could be integrated into the present approach – straightforwardly so in the second case, and with certain stipulations that are required to transfer a post-syntactic approach to a pre-syntactic one in the first case (see below). However, closer inspection reveals that HS also offers a radically different, unique option that is not available in other theories of inflectional morphology: Assuming that the morpho-syntactic context features of the stem are also added successively, which is independently argued for (for *ABA effects) in Müller (2020, ch. 5), morphological realization may have to work with incomplete realization contexts not *after*, but *before* they are complete. In what follows, I sketch such an approach, based on impoverishment in 1. and 3. person past and plural environments in German verb inflection.

Building on Frampton's (2002) earlier analysis, in Müller (2006b) the impoverishment rules in (1) are postulated, which have the effect of neutralizing differences between first and 3. person in [–pl,+past] and [+pl] contexts. This not only accounts for the system-wide syncretism patterns observable here (*Ich/Sie ging*, 'I/she went', *Ich/Sie arbeitete*, 'I/she worked', *Ich/Sie war*, 'I/she was', etc.); it also makes it possible to postulate a general exponent /t/↔[–1] (pairing the phonological information /t/ with the underspecified person information [–1]) in the paradigm that shows up alone in 3. person ([–1,–2]) singular present tense contexts (*Er geh-/t/*, 'He goes') and in 2. person ([–1,+2)] plural (present or past) contexts (*Ihr geh-/t/*, 'You$_{pl}$ go', *Ihr ging-/t/*, 'You$_{pl}$ went'), and together with /s/↔[+2,–pl] in 2. person ([–1,+2]) singular (present or past) contexts (*Du geh-/s/-/t/*, 'You$_{sg}$ go', *Du ging-/s/-/t/*, 'You$_{sg}$ went'), but is blocked by (1-b) in the fourth [–1] present tense context where it would otherwise be expected to occur, viz., in 3. person ([–1,–2]) plural contexts (*Sie geh(ə)-/n/-*/t/*, 'They go'), and by (1-a) in all 3. person past contexts (*Er ging-*/t/*, 'He went', *Sie gingen-*/t/*, 'They went').

(1) a. [±1] → Ø/[–2,–pl,+past]__ b. [±1] → Ø/[–2,+pl]__

Unlike morphological exponence, syntactic operations like Agree (Chomsky (2001)) typically only have access to fully specified morpho-syntactic feature matrices. Therefore, it is standardly assumed that impoverishment must take place *after* syntax, but *before* morphological exponence (but cf. Keine (2010a) for qualifications). Thus, on this view, post-syntactic impoverishment of a feature [F_i] *bleeds* morphological realization by exponents bearing [F_i], and *feeds* morphological realization by exponents not bearing [F_i]; such impoverishment of [F_i] *counter-bleeds* syntactic operations requiring [F_i], and *counter-feeds* syntactic operations requiring the absence of [F_i].

Quite independently of the issue of how impoverishment can be integrated into the present approach based on HS, it can be noted that this concept gives rise to potential problems, both empircally and conceptually. An unresolved empirical issue (first noted by Bobaljik (2002a)) is that properties of the morphological inventory cannot be held responsible for syntactic operations if inflectional morphology is post-syntactic. This means that the standard approach to impoverishment is fundamentally incompatible with the widely pursued hypothesis that *V-to-T movement* can take place in the syntax only if a language has a sufficiently rich paradigm of verb inflection (Roberts (1993), Vikner (1997), Holmberg & Platzack (1995), Rohrbacher (1999)); or with the common idea that argumental *pro-drop* (at least of a certain type) is licensed only if a language has a sufficiently rich paradigm of verb inflection (Rizzi (1986), Jaeggli & Safir (1989)) – in fact, in Müller (2006b) it is argued that argumental *pro* can only occur in a language L if there is no person feature impoverishment in the system of verb inflection in L. A potential conceptual issue arises if one takes seriously the observation that post-syntatic morphological exponence is at variance with the Strict Cycle Condition (see above); but if one concludes from this that morphological exponence cannot be post-syntactic, the concept of post-syntactic impoverishment becomes moot. In view of these considerations, one can try to reformulate the post-syntactic concept of impoverishment as feature deletion as a pre-syntactic concept (Müller (2006b), Ermolaeva & Kobele (2019)); but this comes at a significant price. Thus, in Müller (2006b) it is suggested that pre-syntactic impoverishment *marks* features as morphologically unaccessible, but it does not actually *delete* them, and they remain accessible in syntax. This is parallel to Chomsky's (1995) distinction between deletion and erasure of checked features in syntax, and like this latter proposal, it looks like an artificial step, and a deviation from basic minimalist principles.

However, a comprehensive reconception of impoverishment becomes available in the harmonic serialist approach. Note first that a pre-syntactic approach to morphological exponence presupposes that *complete well-formed sets of morpho-syntactic features* (Stump (2001)) are associated with stems that are realized by morphological exponents (according to compatibility and specificity requirements); and most of the features in these sets are *non-inherent*. This gives rise to a simple question: Where do these complete well-formed sets of morpho-syntactic features come from? Two possible answers suggest themselves. First, one can simply assume a *declarative* approach (Stump (2001)): A complete well-formed set of morpho-syntactic features is defined for each stem; all non-inherent and inherent features are then simultaneously present. Second, one can develop an approach based on *incremental addition* of features: A complete well-formed set of morpho-syntactic features is generated incrementally, by adding, in a stepwise fashion, non-inherent features to the stem, which is initially only equipped with its inherent features. It is this latter approach that will be pursued in the project: Impoverishment effects arise when morphological exponence takes place before the set of context features on stems is complete; instead of early deletion (before morphological exponence), there is late addition (after morphological exponence). Thus, the core hypothesis to be investigated is (2).

(2) *Hypothesis A*:
Impoverishment effects are instances of *premature exponence* that result from *late addition* of context features to the stem in pre-syntactic, Merge-based HS.

Given (2), opacity relations that hold for standard impoverishment are reversed: Pre-syntactic impoverishment (i.e., late addition) of [F_i] *counter-feeds* morphological realization by exponents bearing [F_i] and *counter-bleeds* morphological realization by exponents not bearing [F_i]; and it *feeds* syntactic operations requiring [F_i], and *bleeds* syntactic operations requiring the absence of [F_i]. To execute this idea for the case of the impoverishment effect captured by (1-b), constraints like (3-ab) can be adopted.

(3) a. EXPO←FEAT([–1]):
A stem feature [–1] in the environment [–2,+pl] requires exhausting all morphological arrays.
b. FULLSPEC:
Each stem has a complete well-formed set of morpho-syntactic features.

Given that FULLSPEC must be ranked higher than the MERGE CONDITIONS (MCs) for the morphological arrays identified by the features [T] and [Agr], the initial optimizations of morphological derivations will successively add features to the stem, one after the other: Every feature addition is a single operation, and outputs can differ from inputs only by application of maximally one operation. (In contrast to phonology, it is fairly uncontroversial what counts as a single operation in morphology and syntax). In the normal course of events, when all the contextual features on the stem are in place, morphological exponents are added to the stem (again in a stepwise fashion). However, if the impoverishment constraint EXPO←FEAT([–1]) outranks FULLSPEC, [–1] can be added to [–2,+pl] (as required for the syntax) only if all morphological exponence has taken place, in optimal violation of FULLSPEC. And this means that [–1] is not available for exponence in this context, which produces the impoverishment effect. The crucial step of the derivation is illustrated in (4). By assumption, earlier steps have added the non-inherent features [–past], [+pl] and [–2] to the weak ([–str]) V stem taken from the lexicon, thereby successively reducing the number of FULLSPEC violations incurred at the outset (here, the number of digits accompanying the output candidates reflects the number of prior optimization rounds, the two morphological arrays for T and Agr are identified by { }, and COMPSPEC stands for the faithfulness constraints deriving compatibility and specificity). However, at this point adding the final context feature [–1], as in output O_{2222}, fatally violates EXPO←FEAT([–1]), and the optimal candidate O_{2223} starts satisfying the MCs, by merging a (zero) T exponent first.

(4) *Premature exponence*

I_{222}: V:[–str,–past,+pl,–2], [•T•], [•Agr•] {[$_T$ /te/ ↔[+past,–str]], [$_T$ /Ø/ ↔[–past]], .. } {[$_{Agr}$ /n/ ↔ [–2,+pl]], [$_{Agr}$ /t/ ↔ [–1]], .. }	EXPO← FEAT–1	FULL SPEC	MC T	MC AGR	COMP SPEC
O_{2221}: V:[–str,–past,+pl,–2], [•T•], [•Agr•]		*	*!	*	
O_{2222}: V:[–str,–past,+pl,–2,–1], [•T•], [•Agr•]	*!		*	*	
☞O_{2223}: V:[–str,–past,+pl,–2]-Ø, [•Agr•]		*		*	
O_{2224}: V:[–str,–past,+pl,–2]-n, [•T•]		*	*!		

In the following optimization step, adding [–1] will still not be an option, for the same reasons, so the derivation merges the Agr exponent /n/↔[–2,+pl] in order to satisfy MC(Agr). Importantly, merging /t/↔[–1] will never be possible: Due to EXPO←FEAT([–1]), [–1] cannot be present before exponence is finished, and merging /t/↔[–1] in the absence of [–1] on the stem will always be filtered out because of a gratuitous violation of low-ranked COMPSPEC. Finally, when the constraint profile cannot be improved anymore by merging an exponent, the final FULLSPEC violation can be removed by adding [–1].

Needless to say, this radical departure from orthodox approaches to impoverishment gives rise to a number of non-trivial *questions* and makes a number of novel *predictions*, both of which need to be carefully investigated. E.g., an immediate *question* arising with respect to the derivation just laid out is what happens if the features are added in a different order, such that [–1] would not in fact find the critical [–2,+pl] context blocking its insertion because at least one of these two features is only added later. One possible answer might be that non-inherent features are added in a *fixed order*. On this view, there may be a fixed hierarchy of features (or feature classes). This then predicts that if α can be impoverished in the presence of β, β cannot be impoverished in the presence of α. Indeed, an approach to impoverishment along these lines has been suggested by Noyer (1997). However, the potential problem here is that it is not clear that cross-linguistically invariant hierarchies can be justified; e.g., the impoverishment effects postulated for gender, number, and person in Halle & Marantz (1994), Müller (2006b), and Baier (2018) go in the opposite direction from those postulated by Noyer. A possible way out might be to adopt language-specific, or context-specific, hierarchies. Alternatively, it might be that features can be added in any order, but alternative orders will not undermine that intended impoverishment effect. In the case at hand, one might plausibly add a high-ranked constraint ensuring

that the addition of a stem feature that is not subject to impoverishment requires *absence of exponence*; it can be verified that this will then yield a *no good output* scenario (Grimshaw (1994))): The final optimal candidate has an underspecified feature matrix associated with the stem, and cannot be used in syntax.

Let me also mention just one clear *prediction* of the new approach: Whereas standard post-syntactic impoverishment can in principle affect *all* morpho-syntactic features, the pre-syntactic harmonic serialist approach predicts that only *non-inherent features* can be subject to impoverishment: If a feature cannot be added, it cannot be added late. Interestingly, to the best of my knowledge, impoverishment of inflection class features (as a clear case of an inherent feature) has so far almost never been proposed; and the only case that I am aware of (Trommer (2008b) on Amharic verbs) is extremely unusual in that it reanalyzes a derivational change of inflection class resulting from prefixation (i.e., the creation of a different verb) as inflection class impoverishment of the V stem *in the presence of the derivational prefix*. Furthermore, Bobaljik (2002b) proposes impoverishment of gender on Russian pronouns; Noyer (1997) proposes impoverishment of gender in the Afro-Asiatic prefix conjugation; and Sauerland (1996) proposes impoverishment of gender on adjectives; but gender is not inherent in any of these cases. Still, it might be conceivable that there is evidence for impoverishment of inherent features. For instance, dative plural, instrumental plural, and locative plural environments in Russian noun inflection systematically neutralize inflection class differences (with *am*, *ami*, *ax* occurring throughout). This might either indicate that the prediction is too strong (and might then suggest a reconceptualization of all inherent features as also non-inherent, as has sometimes been argued in approaches where (inherent) gender and class are viewed as separate heads); or it might support a further distinction between *empirically vacuous impoverishment* (there is no alternative dative exponent that would need blocking in Russian plurals) and *empirically non-vacuous impoverishment* (as in the German case analyzed above), with only the latter in need of a theoretical implementation. To address these questions, the project will undertake a thorough and comprehensive analysis and classification of *system-wide patterns* of syncretism in the world's languages for which impoverishment (or referral) has been proposed, or might initially suggest itself (incorporating evidence from the Surrey Syncretism Database).

2.3.2 Exponent Drop

Another phenomenon that is pervasive in inflectional paradigms is the selective non-occurrence of morphological exponents in certain contexts where they would a priori be expected to show up; here I will refer to this effect as *exponent drop*. One case that has received a lot of attention in the literature since Anderson (1992) is the exponent drop after /mʊn/ in Potawatomi verb inflection. Two suffixal Agr exponents are in principle available for transitive verbs like /wap(ʊ)t/ ('see', inanimate object), /wap(ʊ)m/ ('see', animate object); for present purposes, these can be called Agr_2 and Agr_3 (Agr_1 is a prefix slot which is not relevant for the present discussion). E.g., in (5-a), Agr_2 is realized by /nan/↔[+1,+pl,acc], and Agr_3 by /(ə)k/↔ [–1,–2,+anim,+pl]. However, if Agr_2 is realized by /mʊn/↔[+1,+pl], as in (5-b), Agr_3 cannot be realized at all. The effect is more general: All Agr_3 exponents are barred in the presence of /mʊn/ as an exponent of 1. person plural nominative; the inanimate plural exponent /(ə)n/ and the 3. person obviative exponent /ən/ are blocked in the same way. This is shown for the latter case in (5-c).

(5) a. n-wap(ʊ)m-ək(O)-[$_{Agr_2}$ nan]-[$_{Agr_3}$ ək] 1-see-INVERS-1.PL.ACC-3.ANIM.PL → 'They see us.'
b. n-wap(ʊ)m-a-[$_{Agr_2}$ mʊn]-(*[$_{Agr_3}$ ək]) 1-see-DIRECT-1.PL-3.ANIM.PL → 'We see them.'
c. n-wap(ʊ)m-a-[$_{Agr_2}$ mʊn]-(*[$_{Agr_3}$ ən]) 1-see-DIRECT-1.PL-3.OBV → 'We see him(obv).'

Anderson (1992) accounts for exponent drop by postulating (on the basis of an inferential approach) a highly specific rule of exponence that simply maps an extended stem ending in /mʊn/ to itself; this rule blocks the otherwise expected rules of exponence introducing /ən/, the other /ən/, and /ək/ because it is more specific; as Anderson notes, this is fully analogous to a highly specific zero exponent in lexical approaches. Halle & Marantz (1993) point out two problems with this analysis: First, an intervening preterit exponent /(wa)pʊn(in)/ does in fact not block exponent drop in the Agr_3 slot; but if the effect is non-local, mapping an extended stem onto itself cannot be the solution. And second, a 1. person object Agr_2 is normally realized as /nan/; but before the same preterit exponent /(wa)pʊn(in)/, it surprisingly

shows up as /mʊn/ (which is not specified for case features, unlike /nan/); crucially, this "unexpected" /mʊn/, unlike the "expected" version in environments where it encodes nominative arguments, does *not* trigger exponent drop in Agr_3. In view of this, Halle & Marantz (1993) argue for a radical version of an impoverishment rule that deletes not just features, but the whole Agr_3 slot. This rule is assumed to apply non-locally in the presence of [+1,+pl] features in Agr_2; and it must not be fed by the (regular) impoverishment rule that removes the [acc] feature in preterit environments, and that is responsible for the occurrence of the initially unexpected /mʊn/ here. Henze & Zimmermann (2011) point out that an approach based on standard impoverishment of features needs to postulate four distinct impoverishment rules to implement exponent drop after /mʊn/; they propose that some exponents can come equipped with a diacritic signalling that as a consequence of vocabulary insertion, *all* remaining features are also discharged. In contrast, Stump (2001) suggests going back to a version of Anderson's original analysis.

More generally, cross-linguistically exponent drop abounds in contexts where a single verb needs to encode two of its core arguments, particularly so if both of them are local persons (*participant reduction*); cf., e.g., Noyer (1997) on clitic deletion in Nunggubuyu, Halle & Marantz (1993) on participant reduction in Georgian, Trommer (2003) on participant reduction in Ainu, Harbour (2003) on effects of this type in Kiowa, Müller (2006a) on argument encoding in Sierra Popoluca, Arregi & Nevins (2012) on 1. person clitic drop in the presence of an ergative in Ondarru Basque (and other Basque varieties), and Georgi (2017) on participant reduction in Hayu (Kiranti). Similarly, exponent drop has been argued to underlie the non-occurrence of otherwise expected *extended exponence* in Kipsigis (Kouneli (2019)).

Two recurring research questions can be identified: First, how is exponent drop formally implemented in the analysis? And second, what is the trigger for the operation? As regards the first issue, the main implementations that can be found in the literature involve (a) a special operation of *fusion* where two functional heads become one (Halle & Marantz (1993)); (b) a special version of impoverishment that deletes functional heads in toto (Halle & Marantz (1993)), which has been referred to as *impoverishment of (vs.: at) the node* (Harbour (2003)) and as *obliteration* (Arregi & Nevins (2012)); (c) forced non-realization via *optimality-theoretic constraints* (Stiebels (2000), Wunderlich (2001a), Trommer (2003)); (d) *collateral feature discharge* (Henze & Zimmermann (2011)); and (e) *highly specific zero exponents* (Anderson (1992), Stump (2001)). In fact, highly specific zero exponents have regularly been used to account for instances of exponent drop, also outside the realm of argument encoding; see, e.g., Halle & Marantz (1993, 1994) on strong verb inflection in English and Spanish object clitics, respectively, Trommer (1999) on verb inflection in Arabic (and argument encoding in Georgian), or Stump (2001) on verb inflection in Bulgarian. From a conceptual point of view, none of these means to implement exponent drop is entirely unproblematic; they are extremely powerful and lack independent motivation. In addition, the concept of highly specific zero exponents is at variance with an *iconicity* meta-principle that is often presupposed in morphological analysis, and that has been made explicit by Wiese (1999): Similarity of function implies similarity of form – the more morphosyntactic features an inflectional exponent is characterized by, the more phonological material it consists of. As regards the second issue, it is an open question whether systematic triggers can be identified that give rise to exponent drop, beyond some easily discernible tendencies (e.g., local vs. non-local person), and what form they take.

In view of all this, the project sets out to pursue a new approach to exponent drop that is based on the operation of *structure removal* (Müller (2018)). Structure removal is independently motivated not merely for various reanalysis effects in the syntax; it is also of paramount importance for the approach to *disjunctive blocking* developed in Müller (2020, ch. 4). In morphological arrays instantiating disjunctive blocking, all exponents, except for the least specific elsewhere exponent, come equipped with a feature [–F–] for removal of an [F]-exponent that is part of the extended stem. Typically, a more specific exponent merged later will remove a less specific exponent merged earlier (but self-removal is also an option). The new idea for deriving cases of exponent drop then is that morphological exponents may not only remove, via [–F–] features, exponents of *their own* morphological array, but may also remove exponents from *other* arrays: An [F]-exponent may carry a feature [–G–]. Thus, we end up with (6).

(6) *Hypothesis B*:
Exponent drop effects are instances of *structure removal* brought about by other exponents in

pre-syntactic, Merge-based HS.

Structure removal is a highly restrictive concept, and such an approach automatically makes a number of predictions. First, structure removal obeys the Strict Cycle Condition; therefore, exponent drop is predicted to occur only under strict locality. As regards the apparently non-local case of exponent drop in Potawatomi addressed above, this may imply an account in terms of *morphological movement* (which comes for free in this approach). Second, there can be no multiple structure removal by a single exponent. Third, an exponent that is subject to exponent drop must have been part of the word at some point, so there may in principle be reflexes of its earlier presence. And fourth, since structure removal is feature-based, the trigger contexts for exponent drop can be implemented by optimization procedures instantiating the feature on an exponent (which is blocked with the unexpected /mʊn/ in Potawatomi).

Finally, it is worth noting that since a [–F–] feature for structure removal on an exponent can delete *any* item of type F, as things stand the approach may in principle also be compatible with the removal of the whole initial lexical stem itself, by an exponent that was merged with it, and leaving this exponent intact. Interestingly, exactly this phenomenon has been reported for a number of languages (see, e.g., Zamponi & Comrie (2020) on verb root ellipsis in the Great Andamanese language Akabea).

2.3.3 Deponency

The third main phenomenon to be investigated from the new perspective of HS is deponency. The (generalized) concept of deponency characterizes morpho-syntactic scenarios in the world's languages that resemble deponent verbs in Latin, Classical Greek, and Sanskrit (where passive morphology accompanies active syntax) in that what looks like a 'wrong form' is obligatorily used. For instance, with the deponent verb *hortārī* ('urge') in Latin, it looks as though passive forms are used with active functions (passive contexts cannnot be realized at all; i.e., the paradigm becomes defective); thus, whereas the forms for 3. person present indicative active and passive contexts of a regular verb like *regere* ('rule') are *regit* and *regitur*, respectively, *hortātur* is the form used with the deponent verb *hortārī* ('urge') in the corresponding active contexts. As is clear from the contributions collected in Baerman et al. (2007), there are many more instances of deponency. E.g., in Archi the deponent nouns *haʕtəra* ('river') and *cʼaj* ('female goat') employ plural exponents in singular environments (Corbett (2007), Hippisley (2007)). Thus, the ergative singular forms are derived by adding an ergative plural exponent *ɬaj*/*čaj* to the stem: *haʕtər-čaj*, *cʼej-ɬaj*; as with many other deponency phenomena, there is nevertheless no defectivity: Use of the ergative plural marker in singular contexts with deponent noun stems does not preclude the use of the same marker in plural contexts, which has forms that are still distinguishable since the system involves extended exponence and there is also either a bare plural marker in plural contexts which does not show up in the singular, or plurality is indicated by stem alternation: *haʕtər-mul-čaj*, *cʼohor-čaj*.

There are various kinds of approaches to deponency in the more recent literature (cf. Müller (2013), Grestenberger (2017)). A first approach holds that there is no mismatch after all upon closer scrutiny. This approach comes in various versions. One possibility is that the features realized by the respective forms are actually much more *abstract* than one would initially assume, and perhaps motivated exclusively by the syntax (Bobaljik (2007), Keine (2010b), Grestenberger (2014)). Another possibility is that there is no mismatch because the features that are realized are *morphomic* (Aronoff (1994)); there is a relation between syntax (where features like active and passive play a role in Latin) and morphology (where, on this view, the "passive" forms realize some morphomic feature that does not signal *genus verbi*), but it is indirect (Kiparsky (2005), Brown (2006), Hippisley (2007)). A third possibility in this general kind of approach that denies the existence of a mismatch is to assume that, e.g., deponent verbs in Indo-European languages can form a semantically defined natural class with other, more obvious instances of non-active morphology after all (Xu et al. (2007), Kallulli (2013), Alexiadou (2013, 2019)).

Next, the idea has been widely pursued that deponency involves a mismatch between the morpho-syntactic property set that a given deponent exponent realizes, and the interpretation of these contextual features. Here the realization of the contextual feature matrix by the exponent is perfectly faithful, but the ultimate interpretation of this feature matrix is not. These kinds of analyses (called *property deponency* in Stump (2007)) have been pursued by Stump (2007), Embick (2000), and Kiparsky (2005).

Finally, an account of deponency that naturally suggests itself relies on grabbing the bull by the horns: Here it is postulated that the phenomenon does indeed involve the use of a 'wrong' (i.e., unfaithful) morphological exponent for a given matrix of morpho-syntactic features; i.e., it instantiates *repair*. This type of analysis (*form deponency*; Stump (2007)) has been pursued in Stump (2006) and Weisser (2014). In Müller (2013) it is argued that SPOT immediately lends itself to an implementation of such an approach to deponency. Let me briefly outline the working of this optimality-theoretic approach.

The basic assumption is that a deponent stem is accompanied by a feature co-occurrence restriction stating an incompatibility with one or more morpho-syntactic features provided by the context; and there is an undominated constraint LEX that demands adherence to lexically marked idiosyncrasies and thus precludes the concatenation of a morphological exponent that is specified for the feature(s) with such a stem. This then gives rise to a violation of the general compatibility requirement (via IDENT) in the optimal output, assuming that in deponency environments, there is no other compatible exponent that would also satisfy LEX. Based on these assumptions, the account of deponent nouns in Archi like *haʕtəra* ('river') looks as follows. This stem bears a feature co-occurrence restriction **[+gov,–pl]* (where [+gov] characterizes the ergative), so that it cannot be combined with a morphological exponent bearing these features without fatally violating LEX. In ergative plural environments, choice of the maximally faithful exponent (/čaj/) is unproblematic because it does not violate LEX. In contrast, in ergative singular environments, where a morphological exponent /li/ would normally be expected as the optimal marker of case, LEX now forces the choice of a plural exponent (/čaj/) again; and this time the same exponent that emerges as optimal in plural contexts is in violation of IDENT. The competition is illustrated in (7): O_1 has the faithful erg.sg. /li/ exponent that fatally violates LEX; O_2 has a nom.sg. exponent /Ø/ that fatally violates IDENT-GOV, and O_3 has the erg.pl. exponent /čaj/.

(7) *Ergative singular, deponent noun stem*:

I: haʕtər-: [+gov,–pl], **[+gov,–pl]*	LEX	IDENT GOV	IDENT NUM	MAX
O_1: haʕtər:[+gov,–pl]-li:[+gov,–pl]	*!			
O_2: haʕtər:[+gov,–pl]-Ø:[–gov,–pl]		*!		
☞O_3: haʕtər:[+gov,–pl]-čaj:[+gov,+pl]			*	

In principle, there do not seem to be particular problems with transferring such an approach based on SPOT to the present approach in terms of HS. However, as before, the properties of the present realizational, lexical, pre-syntactic, and Merge-based approach to inflectional morphology might also make a new perspective on generalized deponency possible. As with Hypothesis A in the case of impoverishment, the new approach to deponency can exploit the idea that the complete well-formed set of morpho-syntactic features associated with a stem is generated *incrementally*, in a stepwise fashion. This opens up the possibility that deponent stems are not in fact associated with a prohibition against the realization of certain kinds of features on exponents (as in (7)); rather, they *inherently* bear certain kinds of morpho-syntactic features which are normally *non-inherent* features for this kind of stem.

(8) *Hypothesis C*:
Deponency can be traced back to *misguided faithful exponence* that results from the early presence of an *inherent* feature on the stem which is subsequently overwritten by the proper *non-inherent* context feature in pre-syntactic, Merge-based HS.

For instance, for the case of deponent nouns like *haʕtəra* ('river') and *cʼaj* ('female goat') in Archi, one might assume that they are inherently specified as [+pl]. On this view, the enrichment of the categorizing head by the proper number feature ([–pl], in the relevant case), which can be taken to override any prior specifications on the stem (since this is the feature that is syntactically and semantically interpreted), comes too late to block inflection via the maximally faithful plural exponent. To distinguish between [–gov] (i.e., absolutive) environments (where there is no 'wrong' exponent) and [+gov] (i.e., ergative, genitive, dative, etc.) environments (where deponency occurs), one might stipulate that [+gov] is introduced earlier on a categorizing head than [–gov]. In effect, this would amount to a *property deponency* analysis (in Stump's (2007) terms), and would not instantiate an instance of *form deponency* anymore. Also, the approach would bear a certain resemblance to one of the two analyses of

deponency devleoped in Embick (2000), which also relies on the assumption that stems can have a pre-specified feature that may lead to a mismatch with the feature required for the syntactic derivation. In both cases, when the initial feature that is inherently present on deponent stems is eventually overwritten, this comes too late, giving rise to a typical counter-feeding scenario.

It remains to be seen whether such an approach, once properly developed, can emerge as empirically superior to the form deponency approach developed on the basis of SPOT (and to the other approaches to deponency mentioned above). For now, there is one property at least which makes it potentially attractive from a conceptual point of view: It recognizes a deep similarity between impoverishment and deponency (*premature exponence*) which is not really brought to the fore in any of the other approaches.

2.3.4 Paradigm Gaps

Current approaches to inflectional morphology relying on underspecification of morphological exponents all converge on the assumption that all paradigm cells (or all syntactically defined environments) can be realized in some form; typically, there is some radically underspecified elsewhere exponent in every system, and if there is not, zero exponence is predicted (see, e.g., the Identity Function Default in Stump (2001)). For this reason, paradigm gaps pose a problem for morphological theory: In these cases, there is simply *no* form of the stem that can successfully be used by speakers, and ineffability arises. A widespread intuition about the phenomenon is that speakers cannot decide between two options which both seem available in principle, but which also are both problematic. Nevins (2014) invokes the analogy to Buridan's ass in this context – i.e., the donkey that cannot decide between a trough and a stack of hay that are equally close, and ultimately dies of thirst and hunger.

There are several ways to account for paradigm gaps. A standard approach is developed in Halle (1973). On this view, the morphological component may produce certain forms which are then assigned the feature [–lexical insertion], and this makes them unusable in the syntax, by brute force. However, whatever the merits of this (and other) approaches to paradigm gaps, it is clear that they do not faithfully implement the idea underlying the Buridan's ass analogy. In view of this, in Müller (2020, ch. 6), the first outlines of a possible analysis based on HS that does respect the Buridan's ass intuition are tentatively developed. Empirically, the focus is on three cases of paradigm gaps reported in the recent literature.

First, Baerman (2011) addresses paradigm gaps that arise with certain stems in the genitive plural of weak feminine nouns in Icelandic. The basic premise is that there is a homophony avoidance requirement according to which nominative singular forms and genitive plural forms must not be identical. Whereas a weak feminine noun stem like *lyg* ('lie') takes an /i/ exponent in the nominative singular (*lyg-i*) and an /a/ exponent in the genitive plural (*lyg-a*), a weak feminine noun stem like *tung* ('tongue') respects the requirement by adding an epenthetic /n/ in genitive plural contexts (*tung-a* vs. *tung-n-a*). However, given that a noun stem like *hol* ('hole') is incompatible with the epenthetic /n/, the fact that it takes a regular /a/ in the nominative singular (*hol-a*) implies that it gets caught between a rock and a hard place in genitive plural environments: **hol-a* violates the ban on homophony, **hol-n-a* violates the lexically specified ban on adding /n/ to the stem, and as a consequence a paradigm gap arises.

Second, Pertsova (2016) is concerned with a paradigm gap in 1. person singular present tense contexts with certain verbs belonging to the i-conjugation in Russian. A verb like *pylesósit'* ('to vacuum') can neither be realized as **pylesóšu* ('I vacuum'), nor as **pylesósju* ('I vacuum') here. Based on well-formed verb forms like *vožu* (vs. **vozju*, for the verb *voziť*, 'to transport'), one can conclude that a form with palatalization of the stem-final consonant would normally be expected here. However, Pertsova argues that there is an output/output constraint stating that this kind of stem change is legitimate only if it can independently occur elsewhere in the paradigm; this is the case with *voziť*, which has a past passive participle *voženn-ij* ('transported'), but not with *pylesósit'* ('to vacuum'), where no such form exists. On this view, the paradigm gap in 1. person singular present tense environments arises with these verbs because the stem change is both required and prohibited. To implement this assumption, Pertsova (2016) proposes two constraints ([$s^j \rightarrow ş$], $\textsc{Ident}_{\text{lex}}[\alpha\text{-F}]$) against the background of a harmonic grammar analysis assigning weights to constraints, and imposing a threshold score for (optimal) outputs below which speakers have extremely low confidence, so that a paradigm gap will arise.

Third, Sims (2006) investigates a paradigm gap in genitive plural environments in Russian where one would otherwise expect a zero exponent. For instance, *mečtá* ('dream') should have a genitive plural realization as **mečt-Ø*, but this is impossible. Another relevant example is *fat-a* ('veil'), which does not have a well-formed genitive plural form either: **fat-Ø*. The underlying problem in these cases is arguably the assignment of stress. On the one hand, the zero ending would be expected to bear stress but cannot do so; on the other hand, a stress shift to the root is blocked. Hence, a paradigm gap arises.

Thus, for all these three cases, as well as for other cases of paradigm gaps that have been established in the literature, it seems initially plausible to pursue a Buridan's ass intuition as the underlying reason for the illformedness. However, a non-stipulative, principled account implementing this idea in any of the existing theoretical approaches to inflectional morphology is so far outstanding; and it is not immediately obvious what such an account could look like, given the general availability of elsewhere exponents. From an optimality-theoretic perspective, the problem is in fact potentially exacerbated because deriving ineffability is a well-known issue for this approach (Fanselow & Féry (2002), Müller (2015), but also Wunderlich (2001b)).

However, there is a special property of HS which may provide a very simple approach to paradigm gaps that maximally respects the Buridan's ass intuition. As noted above, the approach to disjunctive blocking in the face of extended exponence developed in Müller (2020, ch. 4) necessitates the postulation of [–F–] on exponents in a morphological array that brings about the removal of an earlier, more general exponent. The constraint that ensures that [–F–] features lead to structure removal, by triggering the operation and then undergoing deletion themselves, is a high-ranked REMOVE CONDITION (RC). Importantly, this constraint cannot simply ban the occurrence of [–F–] features in the output; otherwise an exponent bearing such a feature could never be merged in the first place. Therefore, the conclusion is that RC is a *two-level markedness constraint* (Trommer (2001, 2003, 2006), Müller & Thomas (2017)), i.e., a strictly derivational constraint that requires a removal feature [–F–] to participate in (and be deleted by) a Remove operation in the output *if it is accessible on the extended stem in the input* (i.e., not part of the morphological array). Now, McCarthy (2016) has pointed out that such two-level markedness constraints are potentially dangerous for HS because they can give rise to infinite loops, and "undermine the convergence guarantee". This problem does not show up with RC, which *consumes* resources: Once an exponent has been taken from the morphological array, it is irrevocably gone, and cannot be re-used later in the derivation. However, the situation may be different with other constraints, which may indeed trigger infinite loops; and this scenario may underlie paradigm gaps:

(9) *Hypothesis D*:
Paradigm gaps result from *infinite loops* triggered by *two-level markedness constraints* that do not consume resources in pre-syntactic, Merge-based HS.

Thus, the paradigm gap with genitive plurals of certain weak feminine noun stems in Icelandic might be traced back to the interaction between a standard constraint blocking the use of /n/ and a (higher-ranked) two-level markedness constraint demanding that if nominative singular and genitive plural are identical in the input, they must be different in the output. This gives rise to a Burdidan's ass derivation *hol* > *hol-a* > *hol-a-n* (because of the Strict Cycle Condition) > *hol-n-a* (by morphological movement) > *hol-a* > *hol-a-n* and so on, ad infinitum. The two cases of paradigm gaps from Russian may receive the same kind of analysis. However, at present it remains to be seen whether Hypothesis D can eventually be established as a viable approach to paradigm gaps: On the empirical side, many more cases of paradigm gaps have to be investigated in detail; and on the conceptual side, the nature and the working of two-level markedness constraints in HS will have to be subjected to close scrutiny.

2.3.5 Morphological Movement

Many theories of inflectional morphology do not allow implementing the concept of movement of exponents for systematic reasons; e.g., this holds for the declarative approaches Paradigm Function Morphology (Stump (2001)) or Network Morphology (Brown & Hippisley (2012)). Still, in most other approaches, morphological movement is not considered as an option either. As a matter of fact, a

complete absence of movement has been argued to be *the* central difference between morphology and syntax in Wunderlich (2008). One prominent exception to all this is Distributed Morphology, where *several* distinct movement operations are postulated for the post-syntactic morphological component: downward movement of functional heads (*lowering*), upward movement of functional heads (*morphological merger*), downward movement of morphological exponents (*local dislocation*), *metathesis* of exponents, and so on (Halle & Marantz (1993), Embick & Noyer (2007), Embick (2010), Arregi & Nevins (2012)). However, all these post-syntactic operations are implemented in terms of specific rules that differ substantially with respect to various properties (e.g., as regards the relevance of structural notions, adjacency, upward/downward orientation, etc.). These rules all take the form of syntactic (or phonological) rules as they were employed in the sixties (Chomsky (1965), Chomsky & Halle (1968)), which gives rise to an incongruity when combined with a syntax based on simple minimalist operations of structure-building (Merge) and information-sharing (Agree). Furthermore, there is no *theory* of morphological movement in Distributed Morphology; and there are no general restrictions on what post-syntactic morphological displacement can and cannot look like. In view of this, I take it to be a welcome consequence of the present approach that it directly, without further ado, predicts the existence of a highly restrictive concept of movement of exponents in the morphological component of grammar; and, exactly as argued by Chomsky (2001) for syntax, a single operation (*constraint-driven Merge*) is responsible both for the occurrence of an exponent as such, and for its dislocation within the word.

The reason that morphological movement comes for free in the present approach can be traced back to what is arguably the core property of HS, viz., the limitation to at most one operation separating input and output. In a nutshell, if a derivation can only carry out one operation on the basis of a given input, an exponent may have to temporarily show up in a position in which it would never show up if the derivation could carry out more operations on the basis of the same input. Thus, as mentioned above, if two MERGE CONDITIONS MC(α), MC(β) show the same ranking as two alignment constraints like $\alpha\Rightarrow$R, $\beta\Rightarrow$R, morphological movement (of α) will typically apply after the two Merge operations. Similarly, if a ranking MC(α) $\gg$ MC(β) is accompanied by an alignment constraint for the α-exponent that requires it at one edge of the extended stem (say, $\alpha\Rightarrow$R), and a higher-ranked alignment constraint demanding that the β-exponent occurs at the opposite edge (e.g., L$\Leftarrow\beta$), then a general constraint like COHERENCE (Trommer (2001, 2008a)) according to which two items α, β have to show up next to each other if they encode the same nominal argument may automatically trigger movement of α from its base position to β: COHERENCE can only become active in outputs that contain both α and β. In these (and other) cases, the derivation is myopic: Merging the α-exponent in the respective position is locally optimal, at an intermediate stage, but would emerge as suboptimal from a global perspective. Interestingly, these reasonings presuppose the Strict Cycle Condition: Merging the β-exponent counter-cyclically from the morphological array would circumvent the need for later movement.

As noted above, there are at least four different areas where morphological movement can be argued to be supported by the available empirical evidence: (i) *discontinuous exponence*; (ii) *phonological reflexes*; (iii) *discontinuous partially superfluous extended exponence*; and (iv) *non-local stem allomorphy*. In all of these cases, there are so far only initial considerations with, except for perhaps (ii), extremely limited empirical grounding. Thus, *discontinuous exponence* is tackled in Müller (2020, ch. 2) only for complex past tense exponents in Wambon (*t-mbo*) and for past participles (*ge-et*) in German; but eventually, the remarks there may lay the foundation for a comprehensive approach to *circumfixation* in the world's languages as an epiphenomenon of morphological movement. Second, *phonological reflexes of morphological movement* in a pre-movement position in the word have so far been identified in Gleim et al. (2019) for a few cases, viz., *ruki* rule application in Sanskrit (Kiparsky (1982)); despirantization in Barwar Aramaic (Khan (2008)); *ni*-insertion in Quechua (Myler (2013, 2017)); vowel harmony in Kazakh (Bowman & Lokshin (2014)); and accent shift in Lithuanian (Kushnir (2018)). In addition, in Müller (2020, ch. 2), a phonological reflex indicating morphological movement in Bemba derivational morphology (Hyman (2003)) is discussed. So far, it seems that the movement-based approach is worth pursuing here because the only available alternatives in the literature that can account for the data either resort to "interfixation" operations that are incompatible with the Strict Cycle Condition (Kiparsky (1982), Hyman (2003)), or need to postulate non-local phonological operations that seem

incompatible with the "normal" behaviour of the phonological processes in the languages under consideration. However, much more empirically grounded work is needed; it also needs to be determined where phonological reflexes of morphological movement and the well-established phonological reflexes of syntactic movement converge, and where they differ. Similar considerations apply in the cases of *discontinuous extended exponence* (where so far only Swahili verb inflection has been addressed in Müller (2020, ch. 4)), and of *non-local stem allomorphy* (where so far only the account of Tamil pronouns in Moskal & Smith (2016) has been locally reanalyzed in Müller (2020, ch. 5)): The analyses developed so far are proof-of-concept-oriented; they show that a movement-based account can be given. However, closer investigation of many more data is needed to determine whether exponent movement systematically underlies these seemingly non-local phenomena – more generally, whether Hypothesis E can and should be maintained. In addition, theory-oriented questions will have to be addressed; e.g., does morphological movement obey standard constraints on movement (like minimality)?

(10) *Hypothesis E*:
Discontinuous exponence, *apparently non-local phonology*, *peripherality of the general exponent in extended exponence*, and *apparently non-local stem allomorphy* follow from *morphological movement* in pre-syntactic, Merge-based HS.

2.3.6 Final Considerations

Investigating hypotheses A–E (as part of empirical studies also encompassing the other phenomena mentioned in 2.2 above) will form the core of the work programme. However, where relevant and manageable, the project will also delve into some adjacent, arguably somewhat smaller areas. Let me just mention two of these here (F_1, F_2). First, as shown by Noyer (1997) (also cf. Frampton (2002)), there is *discontinuous bleeding* in the Afro-Asiatic prefix conjugation, in the sense that a suffix exponent and a prefix exponent may be involved in disjunctive blocking, with one excluding the other one via specificity. Despite initial appearances, it turns out that a movement-based approach is presumably neither needed nor well motivated for this phenomenon; however, on the basis of an approach where the suffix/prefix status of an exponent is exclusively due to alignment constraints (and not to some inherent /–(X)/ vs. /(X)–/ diacritic on the exponent), it needs to be shown that faithful versions of the original analyses of discontinuous bleeding can be maintained. (This has not been done in Trommer (2001) or related work, where the issue also arises.) Preliminary considerations indicate that this, somewhat surprisingly, may indeed be possible (the task has been carried out with pencil and paper for Frampton's approach to Tamazight Berber); it remains to be seen if the result can be generalized.

Second, it is a priori unclear whether underspecification of morphological exponents should be taken to be *minimal* or *maximal*; in many cases, different degrees of underspecification may lead to extensionally equivalent analyses. So far, *learning algorithms* only seem to be able to cover *minimal underspecification* (Pertsova (2007)). However, there is independent evidence from ERP studies pointing to *maximal underspecification* (Opitz et al. (2013)); and preliminary investigations indicate that a simple learning algorithm for maximal underspecification may be within reach if (a) *iconicity* is postulated, and (b) context features are added in a *stepwise* fashion, exactly as postulated on independent grounds for impoverishment and deponency above.

2.4 Data handling

The project will not attempt to come up with databases of the underlying phenomena; in several cases, such typologically informed attempts have already been carried out (perhaps most notably by the Surrey Morphology Group). Rather, for most of the subtopics (impoverishment, exponent drop, deponency, paradigm gaps), the project will develop a database (hosted by Clarin-D Centre Leipzig, see section 2.3 of the application for the coordination project) of theoretically informed classifications of patterns plus taxonomies of *possible analyses*, i.e., *analysis spaces*. This reflects the observation that similar analyses may often be developed in different theories of inflection.

2.5 Other information: Cooperation within the Research Unit

Mor🚲Phon The project on morphological strata of tone shares with the present project the assumption that one and the same linguistic object may give rise to different kinds of behaviour at different stages of cyclic optimization. Furthermore, there is the shared assumption that initial resources can in principle be consumed. Finally, since gradient symbolic representations have been pursued as an alternative to structure removal in Müller (2019), this option may also profitably be investigated, via consultation with the members of Mor🚲Phon, for structure removal in harmonic serialist morphology.

Sem🚲Phon One of the five main research areas in this project has a part with an empirical overlap with Sem🚲Phon, viz. *morphological movement*, based on hypothesis E. However, the overlap is minimal, covering just the reversal of a base order of exponents and seemingly non-local phonology. Extended exponence, discontinuous exponence, and stem allomorphy are not addressed in Sem🚲Phon. Furthermore, the focus there is on phonological and semantic constraints on affix order, none of which are tackled in the present project. As for phonological constraints, the results from Sem🚲Phon will certainly inform the analyses in the present project. In contrast, in a realizational approach to inflection, semantic constraints cannot play a role for the order of inflectional exponents almost by definition; accordingly, the focus in Sem🚲Phon is on derivational exponents. All in all, Sem🚲Phon employs a near-complementary approach on the empirical side. Analogous considerations apply to the conceptual side. The two projects will mutually influence each other, and create an additional value that would not be available outside a shared Research Unit. (All that said, it should be clear from section 2 above how much the present project relies on earlier work by both principal investigators of Sem🚲Phon.)

Syn🚲Syn There are at least two domains where there is intrinsic potential for cooperation with the project on syntactic repairs and cyclic optimization: First, empirically, some of the phenomena to be addressed in the present project lend themselves to analyses based on morphological repair operations; this is obvious for deponency, but it also holds, e.g., for impoverishment. And second, conceptually, Syn🚲Syn will consider, as one possible approach to repair, the harmonic serialist approach of extremely local optimization that the principal investigator developed together with me.

Syn🚲Phon A first instance of cooperation with the project on prosodic dislocation will be based on the question of whether (and if so, how) SPOT and HS can give rise to different approaches to the syntax-prosody mapping. Another instance will certainly revolve around the role of repair, which also plays a fundamental role in Syn🚲Phon. Third, the approach taken in Syn🚲Phon is inherently post-syntactic in nature, whereas the present project relies on pre-syntactic operations. We can therefore expect to learn a lot about when one approach can easily be transferred to the other one, when there is a trade-off, and when there are clear arguments for one over the other.

Syn🚲Sem The main point of convergence with the project on clause-embedding predicates is an interest in the question of how to model seemingly *anti-myopic* optimization phenomena (such as the decision on the status of an embedded negation as expletive or contentful) in a cyclic approach where decisions have to be taken early, without all the relevant information being present.

Syn🚲Mor Cooperation with the project on layers of morphosyntactic number will most straightforwardly involve the concept of extended exponence, and in particular the question of whether multiple exponence of number in languages like Amharic should be viewed as instances of fully superfluous extended exponence (the working hypothesis for both projects would at present be that they should not). Next, the principal investigator's work on non-realization of multiple number exponents in Kipsigis is directly relevant for the present project's approach to exponent drop. Finally, cooperation between the two projects will contribute to the overarching question where pre- and post-syntactic analyses in inflectional morphology can easily be interchanged, and where there are fundamental differences.

Com🚲Asp There will be intensive cooperation with the project on computational aspects of cyclic optimization regarding the basic notions of cyclicity, optimization, and iterativity. Against the background of Hao's work on phonology, it is an open question what the consequences of the one-edit-away-from-the-input property of HS are from a comptuational perspective that seeks to minimize the capacity of grammatical formalisms in morphology and syntax, and the results in this domain will have direct relevance for the present project. Similar questions arise with the concept of structure removal.

More generally, because of the many points of convergence, it can be noted that virtually all of these other projects lend themselves naturally to the *rotation program* specified for the coordination project.

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