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Reconstructing the spread of word-final /n/ deletion in Central Franconian dialects. Internal and geographical dynamics*

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Abstract

This study examines the phenomenon of word-final /n/ deletion (WFnD) in Central Franconian dialects spoken across parts of the Netherlands, Belgium, Luxembourg, Germany and France. The deletion process occurs after schwa and full vowels and manifests itself in different phonological patterns across dialects. The paper presents a comparative analysis based on a selection of local varieties, investigating the effects of the left-hand and right-hand phonological context on WFnD. The theoretical framework of the ‘Life Cycle of Phonological Processes’ serves to reconstruct the diachronic development of WFnD, allowing to trace its progression from systematic phonetic variation to a categorical phonological phenomenon and lexicalized forms. By applying this framework, the study demonstrates how different dialects exhibit WFnD at distinct stages of the life cycle, revealing the systematic nature of its historical unfolding. The findings highlight the role and interplay of prosodic, phonological, morphological and lexical factors conditioning WFnD.

Keywords: phonology; dialectology; Life Cycle of Phonological Processes; sound change; prosody

1. Introduction

This study focuses on the post-vocalic, word-final deletion of the coronal nasal, /n/, (WFnD)¹ in a group of Germanic varieties spoken in a contiguous area covering parts

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¹ This paper uses several abbreviations which are listed here for convenience. CF: Central Franconian dialect area; WFnD: word-final /n/ deletion; syllables rhymes (left-hand contexts for WFnD): {Vn} - short vowel plus n, {-ən} - schwa plus n as part of inflection, {əɪn} - stem-final schwa plus n, {VVn} - long vowel plus n; stD: standard Dutch, lux.: Luxembourgish; Accent 1, Accent 2: the two lexical, tonal/pitch accents of CF; UoWorms: Ubach over Worms (placename); short-hand notation for the presence of final /n/ (bold-face): n - /n/ deletion impossible, n̄ - /n/ deletion possible, _ (underscore): /n/ lexically deleted; U,



Figure 1. Map illustrating the extension of the Central Franconian area across Germany, France, Luxembourg, Belgium and the Netherlands. The black circles indicate the localities for this study (see §5).

of the Netherlands, Belgium, Luxembourg, Germany and France (see Figure 1). The process, which is both productive and lexicalized, applies (or has applied) following schwa or (both short and long) full vowels; where it is productive it is either variable or allophonic; where it applies obligatorily, WFnd is either allophonic or lexicalized. With ‘allophony’ we refer to the situation where one variant of a categorical phenomenon (here: realisation of [n]) occurs in environment x and the other variant

φ, ω, σ: Utterance, phonological phrase, phonological word, syllable (levels of the prosodic hierarchy); UR: underlying representation; MRhSA: *Mittelrheinischer Sprachatlas* (Linguistic Atlas of the Middle Rhine Area); RND: *Reeks Nederlandse Dialectatlassen* (Series of Dutch Dialect Atlases), vol. 8, Blankaert et al. 1962.

(deletion) in all other environments. An allophone is a combinatorial variant of a phoneme, i.e. a positional variant, as opposed to a ‘free’ variant.

This paper will show a first inventory, detailing the internal and external, specifically geographical, distribution of the phenomenon (§§2 and 3). The first-ever comparative in-depth study of WFnD for a modest but balanced sample of local Central Franconian varieties, to be presented in §§5 and 6, focusses on the distribution with an eye on comparative reconstruction and a first, conjectural interpretation of the patterns from the point of view of the theory of the Life Cycle of Phonological Processes in §§4 and 7. Based on the distribution and conditioning of WFnD by phonological context for each single dialect, the theory allows a tentative reconstruction of the diachrony of the internal and geographical spread of the phenomenon.

2. The phenomenon

Generally speaking, WFnD is a widespread phonological phenomenon that occurs, apart from various dialect of Dutch and German, in many other languages, e.g., in Cypriot Greek (Muller, 2002), Ghayeni Persian (Jam *et al.* 2020) or English (Minkova & Lefkowitz 2019). From the perspective of phonological rule typology, WFnD occurs in Central Franconian (henceforth CF) in various forms: in Moselle Franconian, the southern half of the CF dialect group, WFnD comes as allophony. The final nasal typically is subject to *allophonic deletion*: obligatory realization of /n/ if followed by a word beginning with a vowel or /d, t, fʃ, n, h/ and obligatory deletion elsewhere (e.g., [ʃʁaivən di:v] *schreiwen dir*, ‘writing you’, vs. [ʃʁaivə_ ba:l] ‘writing soon’).

In the Riparian dialects and the dialects in the Riparian-East Limburg transition zone, the northern half of the CF group, WFnD is either lexicalized or variable. WFnD is *lexicalized* due to diachronic developments in most post-schwa environments, in a number of monosyllabic and some post-long vowel environments (e.g., /ma:kə_/, standard Dutch (henceforth stD) /ma:kə(n)/, ‘(to) make’, and /a:_/, stD /a:n/, ‘on’, /e:_/ stD /e:n/, ‘one’). WFnD applies *variably* in a set of monosyllabic post-short vowel environments in function words (e.g., /va(n)/, stD /van/, ‘of’, and /ɪ(n)/, stD /ɪn/, ‘in; into’).

Throughout the larger CF group, three main representations of the nasal can be distinguished: variable realisation, allophonic deletion, and lexicalization (lexical presence or absence due to deletion). In the dialects in both groups, it can be established that if deletion applies (or has applied diachronically and has changed the underlying (lexical) representation to the effect that the /n/ has disappeared) then it does so at the end of a phonological word, following a vowel, resulting in a phonetically empty position. No phonetic gradience, neither compensatory lengthening nor nasalization of the preceding vowel is observable.² Although the modern CF dialects show no evidence of this whatsoever, we cannot rule out the

² To demonstrate that the final nasal is entirely lost without a trace, some preliminary auditory and acoustic analyses have been conducted, available here: <https://petergilles.github.io/WordFinalNDeletion>. Comparing a word with and without WFnD applied, the preceding vowel shows no significant differences, indicating that the presence or absence of the nasal does not influence the vowel.

possibility that WFnd had its origin in a phonetic process of weakening.³ However this may be, WFnd has been phonologized, eventually leading, in some dialects under certain conditions, to the absence of the nasal in the underlying representation.

Word-final n-deletion is a highly frequent feature in the many varieties of CF, although there are subtle yet intriguing differences in the (phonological, prosodic but also morphological) conditioning and thus probably its degree of unfolding. Because of its non-gradient nature and given both its enormous variation and multiple conditioning, the phenomenon seems similar to French liaison (Côté 2011; 2017, Lyche et al. 2018): a word which—in isolation and when followed by a consonant-initial word—ends in a vowel acquires a final consonant that is pronounced as a linking segment when the following word begins with a vowel or vocoid. For example, the word *sans* ('without') is usually pronounced [sã], also in e.g. *sans cravate* [sãkʁavat] ('without a tie'), but followed by e.g. *œufs* [œf] ('eggs') it is realized as [sã.z_œf]. The phenomenon is subject to interacting syntactic, prosodic and stylistic constraints as well as to geographical variation. In certain contexts, liaison is obligatory, in others it is variable, and in yet others it is blocked. A subcategory of obligatory liaison concerns cases where the process is lexicalised, as in, e.g., *porc-épic* [pɔʁ.k_e.pik], 'porcupine'.

2.1 Documentation and scholarship

WFnd has been documented in

- dialect texts, e.g. de Bruin et al. (eds 1976) which includes texts in 12 local dialects in the Ripuarian area and the Ripuarian-East Limburg transition zone; Mone (1830: 462ff.) for dialects of Luxembourg;
- descriptions such as Jongeneel (1884: 13), KKD (1987:35) for the local dialects of Heerlen and Kerkrade, which both mention among other things *plei/plai*, stD *plein*, 'square' (N), and *a*, stD *aan*, 'on';⁴ Ternes (2017) for CF of Trier;
- old dialectological data collections (questionnaires and otherwise), such as the *Reeks Nederlandse Dialectatlassen* (RND), i.e. 'Series of Dutch Dialect Atlases'. The data for this project were collected in fieldwork.⁵ They concern 1956 different local dialects and consist of dialect translations of 135 sentences plus isolated words and paradigms; the data of a subset of the dialects sampled are available in the form of narrow phonetic transcriptions;
- dialect dictionaries like Tonnar & Evers (1899), Theissen (2013);
- sound recordings, such as those in the Goeman-Taeldeman-van Reenen database (<https://www.meertens.knaw.nl/mand/database/>), collected between 1980 and 1995 for 613 different dialects of Dutch and Frisian, containing recordings and transcriptions of 1854 words and 22 sentences. The database includes the CF dialects spoken in Voerendaal, Kerkrade, Gulpen, Epen and Vaals (cf. also the 'Nederlandse Dialectenbank' <https://www.meertens.knaw.nl/ndb> at the Meertens Instituut);

³ The same applies to assimilation. For Moselle Franconian there is some evidence for assimilation in the historical development of names whose first constituent originally ends in /ən/: *Bettenburg* > *Beeteburg* and *Meysenburg* > *Meysembourg* > *Meeseburg*.

⁴ Examples in italics are orthographic representations in the cited source(s).

⁵ For the region at issue, the fieldwork was carried out between 1938 and 1948; see §5.3.

- crowd-sourced data for Luxembourgish, using a smartphone application (Entringer *et al.* 2021). Participants were asked to translate short sentences from German or French into Luxembourgish and provide their audio recordings. The stimuli sentences were constructed to cover various linguistic variables, among them several cases of potential WFnD;
- dialect maps, such as those in the *Mittelrheinischer Sprachatlas* (MRhSA 1995–2002), *Variationsatlas vom Lëtzebuergeschen* (Gilles, 2021), *Dialektatlas Mittleres Westdeutschland* (DMW, 2016ff). Like questionnaire-based dialectological data collections, atlases and maps tend to be language area specific.

Although abundant, the documentation is fragmented, unbalanced and of very diverse types and qualities. The research area relevant to this study spans five countries. Consequently, there are practical and methodological problems because there are but few comparable data. It is yet to be established whether, apart from the dictionaries by Tonnar & Evers (1899) and Theissen (2013) and the RND questionnaire data for a number of local dialects, there are any systematic data available for the Belgian part of the CF dialect group.

Post-schwa final /n/ occurs both in German and in Dutch. However, while for the relevant dialects spoken in Germany, the documentation for and description of WFnD includes post-schwa environments, for the relevant dialects spoken in the Netherlands, at least descriptively this is much less the case, since WFnD following schwa is near-obligatory in most varieties of spoken Dutch, including standard Dutch⁶ and the Limburg and Riparian dialects.

The state of the scholarship for WFnD in the CF dialects at large is not very encouraging. Hardly any relevant descriptions and even fewer analyses can be found, except for a few scattered studies, such as

- Jongeneel (1884: 13), which includes relevant observations for the local dialect of the Dutch city of Heerlen, in the Riparian-East Limburg transition zone part of the CF area.
- In his grammar of the Riparian dialects as spoken in the larger Cologne area, Münch (1904:65–66, 96) succinctly describes the conditioning of post-schwa WFnD, as does Christa (1927) for the CF dialect of Trier.
- In more detail, Büsch (1888) and Bruch (1954:25ff.) capture the regularities of WFnD for Luxembourgish, as does Capesius (1966) for a related CF immigrant dialect in Transylvania.
- Ternes (2017) is a somewhat traditional yet observationally thorough and descriptively precise⁷ study of WFnD in the local dialect of the German city of Trier, in the heart of the Moselle Franconian part of the CF area. Ternes' study is one of the majority of approaches of traditional CF dialect features which stop at the borders of the German language area.

⁶ Van Oss & Gussenhoven (1984); Goeman (2001); Van de Velde & Van Hout (2003).

⁷ Despite the fact that prosodic effects are described as grammatical in nature.

- Hardly anything is known about CF in France; Tarral (1903:82ff) briefly mentions that in the village of Falkenberg in Lorraine final /n/ in inflectional suffixes is deleted before non-alveolar sounds.⁸
- Phonological aspects have been discussed for individual varieties by Hinskens (1992, 2009), Girnth (2006) and Gilles (1999, 2006, 2014).

Data from all available studies (including 19th-century ones) have been incorporated in our contribution. Still, we present only few diachronic data, since more reliable diachronic data are barely available for the CF dialects (and presumably for by far most dialects of the Old World). These dialects are older and hardly documented layers of language varieties that are and were almost exclusively used orally. Insofar as they were written, the question is whether this was done phonetically accurately or rather etymologically ‘correctly’ (i.e. with <n>). In principle, this latter consideration does not apply to data collected for dialectological or (historical) linguistic research, but such research did not take off in the CF region until the late 19th century.

Therefore, we could not substantially build the study in our contribution on diachronic facts with great time depth. What we seek instead is to interpret insights distilled from our analyses of the available data against the background of the theory of the ‘Life cycle of phonological processes’, that allows us to reconstruct the diachronic unfolding of WFnd, both internally and geographically. In other words, we use this theory to give time depth to the state of affairs based mainly on mostly 20th century data; the theory is the tool with which we try to retrace the diachronic phases in the language-internal and areal stabilization and spread of the phenomenon on the basis of properties of WFnd in each single variety.

In §4, we will present the theory and demonstrate how it can be put to use in historical phonology.

3. The area where it occurs and its dialectology in broad outline

The Central Franconian area includes all of Luxembourg, larger parts of western central Germany and smaller border regions of the southern Netherlands, eastern Belgium and northern France (see Figure 1). The area is hence cross-cut by the Dutch/German, the Dutch/French, the Luxembourgish/German and the Luxembourgish/French language borders.

Dialectologically, the CF area is located in the heart of the so-called ‘Rhenish Fan’, the westernmost section of the isogloss bundle which forms the watershed between Low German (including Dutch) and High German. Across the five countries, the CF varieties show fundamentally different sociolinguistic embeddings (Auer 2013; Hinskens et al. 2000). Despite the many changes in their position and notwithstanding the increasing pressure of the standard languages, the various CF varieties *par excellence* still display many lexical, phonological, morphological and syntactic

⁸ Near the entrance to the castle of Sierck-les-bains, e.g., one can find a plaque informing about the history of the mocking name of the inhabitants of the village, *d’siirker Ieselen* ‘the Sierck donkeys’. The story is written in the local dialect and contains dozens of occurrences for WFnd (e.g. *e_ Kranken* ‘a sick person’, *vu_ Siirk* ‘from Sierck’).

differences from standard German and standard Dutch. There are still quite a few variable phenomena, the dialect features of which have a wide geographical distribution over the entire CF area.

In phonology, wide-spread features can be identified on two levels. First, supra-segmentally, contrastive tonal accent, a type of pitch accent, is a feature that CF has in common with Limburg dialects (Schmidt 1986; Hermans & Hinskens 2010, Schmidt/Möller 2019, Köhnlein 2020), albeit with vast cross-dialectal variation in the phonetic realization of the accents. There are two accents; in dialectology, they are traditionally referred to as ‘acute’ and ‘circumflex’ (cf. Boersma 2018 and references therein), while in phonological theory they are often referred to as ‘Accent 1’ and ‘Accent 2’. Accents can only be implemented in primarily stressed syllables which have a rhyme containing at least two sonorant segments (or moras). Luxembourgish, located at the south-western periphery of CF does not seem to have productive tone phonology any longer Gilles 2002).

The other phonological properties with a wide geographical spread concern segmental phenomena. The Germanic mid-high vowels *e*: and *o*: did not undergo Old High German diphthongization but were instead raised, resulting in the close vowels *i*: and *u*:, respectively (cf. Schmidt/Möller 2019). Widely spread segmental phenomena also include liaison-type processes such as word-final *t*-/*d*-deletion. Examples are [eç] < /eçt/ ‘real(ly)’, [wɪrək] < /wɪrəkt/ ‘works’ 3sg. pres. indic., [bal] < /bald/ ‘soon’). The phenomenon is comparable to WFnd in several ways, including the fact that there are some indications of lexicalization, but *t*-/*d*-deletion is not confined to CF. It has been investigated for a range of other dialects of Dutch (Goeman 1999) and both British and American English.

4. The theory of the life cycle of phonological processes. Rule typology

Sound change often follows a fixed, unidirectional path from phonetics via grammar (phonology; morphology) to lexicon. This insight is known as the ‘life cycle of phonological processes’ and the most current modern version of the theory has been developed in lexical phonology and related Stratal Optimality Theory (Kiparsky 1995; Bermúdez-Otero 2015; Ramsammy 2015; Hinskens 2019, 2021 but also e.g. Salmons 2021: 169-174, who is critical of several basic assumptions).

0. In this conception of the diachronic development of sound change, the cycle is ignited by linguistically more or less random phonetic variation. It is random in the sense of non-directional, not in terms of results; the pool of variants remains overwhelmingly connected to the basic form. Random phonetic variation is ubiquitous, but in the vast majority of cases it has no consequence.

1. However, occasionally random phonetic variation can become systematic as it becomes cognitively controlled (Bermúdez-Otero and Trousdale 2012). The variation is either unconditioned or exclusively phonetically conditioned, typically both localized and occurring in “a relatively short temporal span” (Janda & Joseph 2003: 206). “Most, if not all, regular sound changes are motivated by the demands of articulation and audition, that is, they occur for phonetic reasons” (Donegan and Nathan 2015: 439). They are lexically exceptionless.

Like random phonetic variation, systematic phonetic variation remains gradient, i.e. the realization of the speech sound in question oscillates and an endless number of subtly different variants exist. But different from random phonetic variation, systematic phonetic variation is directional.

2. An instance of systematic, directional phonetic variation can stabilize to lose its gradient nature and become a post-lexical process. Often such a process applies within or on the edge of a specific prosodic domain inside an utterance, such as the syllable onset or the end of the phonological word. What was originally phonetic variation thus becomes “selectively integrated into the linguistic system” (Kiparsky 1995: 642). But it can remain (quantitatively) variable.⁹ Just like systematic phonetic processes, post-lexical processes are lexically exceptionless and hence “subject to Neogrammarian sound change” (Hargus & Kaisse 1993: 17).

2'. After a certain period, post-lexical processes become structurally fixed; they no longer apply variably, but become obligatory: “Conditions on sound change can then be seen as categorical reinterpretations of the variable constraints that determine the way optional rules apply. [...] When a rule becomes obligatory, its spectrum of contextual conditions is simplified and polarized” (Kiparsky 1995: 659). This development results in allophony, i.e. a situation where there are two potential outputs (of one input segment), which are in complementary distribution. Allophony is one of the outer limiting cases of variation.

3. Subsequently, post-lexical processes can narrow down their domain of application to morphologically simplex or complex words, becoming lexical rules. Lexical rules do not operate across word boundaries. Examples are Latin rhotacism (*honos*, ‘honour’, but genitive *honosis* > *honozis* > *honoris*, ‘of honour’) and the original version of Umlaut.

3'. Eventually lexical rules may even change stems. In Latin, alongside *honos*, a variant *honor* emerged. Another example concerns post-lexical word-final [t] deletion in the Ubach over Worms dialect (see §3). The dialect variants of the standard Dutch verbs /kɔstə/ ‘to cost’ and /meldə/ ‘to announce; to register’, have two stems, one with and one without final /t/: /kɔst/ ~ /kɔs/ and /mɛld/ ~ /mɛl/.

4. Once rules or processes lose their productivity, they tend to become lexicalized or morphologized. Lexicalization occurs either in free morphemes (‘items’) or in bound morphemes (affixes) or both, i.e. the processes or rules freeze and become stored in the lexical representation of specific items or morphemes. Lexicalisation is another outer limiting case of variation. Morphologization is the process through which a former phonological process changes into a morphological operation. An example is again Umlaut, with or without concatenation. In English it has become marginal (*goose-geese*, *foot-feet*, but *crook-creek*); in modern standard German, where it

⁹ Traditionally referred to as ‘free variation’, the object of the ‘variable rule’ of variationist sociolinguistics (Cedergren & Sankoff 1974), where it is investigated with probabilistic or stochastic techniques. That post-lexical processes can indeed be variable is demonstrated, among other things, by the fact that “in Quito Spanish [...] some speakers have a variable phonological rule that categorically voices underlying /s/ in word-final position before sonorant segments” (Bermúdez-Otero 2015:383). It is also evident from the fact that variable French liaison (e.g. *C’est une belle journée*, ‘It’s a beautiful day’, with [setynə] or [seʔynə], *Vous pouvez entendre les musiciens*, ‘You can hear the musicians’, with [puvezãntãdrə] or [puveʔãntãdrə]) is not gradient.

has long been productive, Umlaut is no longer synchronically predictable, cf. *Fuß-Füße*, 'foot-feet', *Grund-Gründe*, 'reason(s)', but *Hund-Hunde*, 'dog(s)'.

The lexicalization process is often steered by token frequency (Phillips 2006). Going from systematic phonetic variation to lexicalization, structural predictability decreases.

5. At the end of the cycle, i.e. after a rule has been lexicalized, it has become extinct. This scenario is known as rule death or rule loss. After their death, sound changes manifest themselves as lexicalized and typically unpredictable correspondences.

There is a second scenario: the mechanism starts anew. Sometimes an old, lexicalized former sound change becomes productive again. This holds, e.g., for Dutch vocalization of postvocalic /l/. Historically it applied after low back vowels, changing the form of items, cf. German *alt*, *Wald*, 'old,' 'wood,' and Dutch *oud* and *woud* (with a back diphthong). In modern Dutch it has become productive again, also following front vowels, making e.g., *Niels*, 'Nils,' *meel*, 'flour,' and *school*, 'school' become homophonous with *nieuws*, 'news,' *meeuw*, 'seagull,' and *schouw*, 'chimney,' respectively (cf. Van Reenen & Jongkind 2000). So postvocalic /l/-vocalization, which took place in Middle Dutch, has gone full circle.

As the case of postvocalic /l/-vocalization illustrates, the life cycle of phonological processes is a continuum, but one in which the two extremes (Neogrammarian sound change, targeting phonemes, and lexically diffuse sound change, targeting lexical items – Labov's (1981) Neogrammarian controversy) sometimes meet, hence a cycle.

This life cycle concerns the ageing of sound change by the imposition of prosodic, morphological, and lexical restrictions, until eventually a point is reached where it merely concerns single lexical entries and is no longer part of the computational system of grammar. The life cycle is a common, yet complex process involving physical, cognitive as well as social mechanisms. One of the cognitive mechanisms is related to language acquisition. Salmons (2021:172) points out "that the cross-module patterns connect easily in language acquisition and use. That is, phonetic changes in one generation can set the stage for phonological reinterpretation by learners", resulting in a systematic phonetic or post-lexical process. Because of its complexity, the cycle proceeds slowly and, because of differences in phasing, it easily results in differences between related dialects (cf. Bermúdez-Otero 2015; Sen 2023) and languages. Especially related dialects tend to go through the same sound changes, but they do not necessarily do so at the same rate and this is a cause of micro-variation.

To use the theory to reconstruct the internal and geographical unfolding of WFnd in the CF dialects, we need to 1/ make a balanced and representative selection of dialects and 2/ check the rule-typological status of WFnd for each dialect. Table 1 summarizes the main properties of the relevant rule types.

Some clarifying remarks are in order:

- 'later post-lexical' means allophonic and this, unlike 'early post-lexical', is no longer a matter of variation, but of a structurally determined distribution of variants (in casu allophones).

Table 1. The relevant rule types and the main properties of each type

	rule type	conditioning	lexical exceptions?	variation?	gradience?	productive? predictable?
1	systematic phonetic	unconditioned or phonetically conditioned	no	yes	yes	maximal
2	post-lexical early	prosodic			no	
2'	later					
3	lexical	morphological	yes	no	no	minimal
4	lexicalization	lexical				
5	lexically diffuse (dead rule)					

- Re ‘lexical rule’: ‘morphological conditioning’ means the rule has access to word-internal structure; some lexical rules apply only in derived words, whereas post-lexical rules apply across the board (Hargus & Kaisse 1993:16), blind for grammatical boundaries.
- Re ‘lexicalization’ and ‘lexically diffuse’: lexical conditioning means, among other things, sensitivity to frequency of usage (Phillips 2006).

Moreover, for the early phases in the cycle, there may be geographical correlates: phonetic variation is often localized, post-lexical processes not infrequently show geographical spread.¹⁰ Cf. Robinson & van Coetsem’s (1973: 341-345) discussion of the possible relationship between the internal development of a sound change (in casu the High German consonant shift) and its transmission and geographical spread.

5. A first comparative study. Preliminaries

Our study is based on the hypothesis that WFnD, despite its distribution over several countries, is a feature which has a common historical basis which then underwent a divergent development in the various dialects, and which can be subjected to a uniform analysis for all CF varieties. For methodological reasons and for reasons of feasibility, we confine the following overview to a well-balanced selection of regional varieties spoken in Belgium, Germany, Luxembourg and the Netherlands (see Table 2).

Thus, two local varieties (Luxembourg and Trier) represent the Moselle Franconian group, two (Eupen, UoWorms) the Ripuarian group. This sample is balanced for the degree of documentation and available empirical data of the varieties; socio-geographically, it is definitely less balanced, as Luxembourg and Trier are cities, whereas Eupen and UoWorms are large villages. However, since we focus more on the historical varieties and less on recent developments, the differences in population

¹⁰ An example of the former is the fact that in the Amsterdam urban vernacular onset [s] is sometimes realized as slightly postalveolar. An example of the latter is deletion of word-final /t/ and /d/ in large groups of dialects of German, Dutch and English.

Table 2. Overview of the four varieties investigated in this study

variety	country	dialect area	standard language(s)
Eupen	Belgium	transition Riparian/East- Limburgian	German/French
Ubach over Worms ('UoWorms')	Netherlands	Riparian; transition Riparian/East- Limburgian	Dutch
Trier	Germany	Moselle-Franconian	German
Luxembourgish ¹¹	Luxembourg	Moselle-Franconian	Luxembourgish/German/ French

size, regional importance, history, and the overall socio-economic profiles of the four places seem to be of secondary importance.

As a multifaceted, complex phonological phenomenon, WF_nD is constrained by many phonological factors, which, in their interactions, constitute different stages in the development of WF_nD in the respective varieties. WF_nD is constrained by the structure of the left-hand side and, as a sandhi phenomenon, by the right-hand side. On the left-hand side the syllable nucleus (schwa, long vowel or short vowel preceding the nasal) will be shown to play a role. On the right-hand side, the 'depth' of the following prosodic boundary (sensu Nespor & Vogel 1986) as well as the nature of the first segment after this boundary matter (cf. (1) for a schematic overview).

(1) Schematic overview of the constraining phonological factors

Left-hand side	Right-hand side
$\left\{ \begin{array}{c} \mathfrak{a} \\ W \\ V \end{array} \right\} \quad n$	$\left\{ \begin{array}{c} \omega \\ \varphi \\ I \\ U \end{array} \right\} \quad \dots$
Composition syllable rhyme	Type of prosodic boundary
	Following segment

In our account, most of the relevant words from the four varieties are IPA-transcribed, as it is crucial for our analysis to identify the relevant phonetic-phonological structure (i.e. long vowel/diphthong, short vowel, schwa). Wherever phonetic detail is not relevant in the examples, we use a simplified transliteration only.

¹¹ Today Luxembourgish is an 'Ausbau' language and not a dialect anymore. For this historical phonological analysis, it is, however, justified to compare it with the other dialects, as its origin is also clearly dialectal (cf. Gilles 2019).

For a proper understanding of the deletion or realization of the nasal, two levels of description would be required. For each level, we use specific symbols:

Phonological (underlying)

- n** cannot be deleted (i.e. WF_nD blocked)
- ɳ** can be deleted (i.e. subject to either variation or allophony)
- lexically deleted (i.e. WF_nD lexically stored)

Phonetic

- n** realised
- ∅** not realized

The various possible constellations can be presented as in Table 3:

Table 3. The phonological (horizontal) and the phonetic (vertical) description of WF_nD

	n	ɳ	–
n	✓	✓	impossible
∅	impossible	✓	✓

However, our data¹² allow us to specify the status of final /n/ in the underlying representation and hence to indicate the different types of WF_nD. Thus, we will only use the symbols **n**, **ɳ**, **–** (in bold face).

As has been explained in §2.1, for WF_nD we have data of various types. There are or on specific CF /or on specific CF dialects, dialect dictionaries, data collected for dialect atlases (sound recordings and/or transcriptions), dialect maps as well as recently crowd-sourced data. Based on these data, we present two types of analyses: on the one hand, there are analyses of data for a specific dialect. For each context and condition, we examine the properties of WF_nD to determine its rule-typological status. On the other hand, we present the results of advanced statistical analyses of data aggregated across an entire dialect group; these analyses ultimately serve the same purpose.

We have tried to develop a sufficiently differentiated approach to cover the various manifestations of WF_nD across the dialects of the CF area, where the left-hand side (§5.1) and the right-hand side (§5.2) will be discussed separately, followed by two case studies in §5.3.

¹² And the fact that we are native speakers of two of the dialects studied and passively know the directly related dialects quite well.

5.1 Left-hand phonological environment and related conditions

The composition of the syllable rhyme plays a crucial role in determining whether the final nasal can undergo deletion, as deletion occurs only following a vowel.¹³ A key distinction lies in whether /n/ is preceded by a full vowel or by schwa, as this factor significantly influences the process. A preceding schwa may be part of either an inflectional morpheme or the lexical stem, a preceding full vowel may be either long (tense) or short (lax); full vowels are always part of the stem. Based on these distinctions, four different contexts can be identified:

1. schwa, part of an inflectional morpheme: {-ən}
2. schwa, part of lexeme/stem: {ən}
3. long full vowel/diphthong: {VVn}
4. short full vowel: {Vn}

While conditions 1. and 2. necessarily occur in a final unstressed syllable of at least bisyllabic words, conditions 3. and 4. pertain to monosyllabic words. As a result, except for a few special cases, post-full-vowel WFnD occurs only in monosyllabic items and not in bi- or polysyllabic words with a stressed final syllable. Therefore:

(2) Ubach over Worms ¹⁴		Luxembourg	
bə'na ¹ n	'banana'	bə'nən	'banana'
və'ɾeɪ ² n	'association; club'	ro'ma:n	'novel'
bə'ɣɪ ¹ n	'begin' (VInf)	nə'tsɛ̃ʝən	'nation'
bə'ɣɪ ² n	'beginning' (noun)	ən'tæn	'antenna'

For the four conditions, the grammatical status of the word may also play a role, i.e. the distinction between lexical words (1., 2. and 3.) and function words (3. and 4.), which underlines the multi-causality of WFnD (cf. also the conditioning of *liaison* in French).

5.1.1 Post-schwa, part of inflectional morpheme {-ən}

The context {-ən} is the most frequent type of constellation for the final nasal and it has also the most straightforward phonological interpretation. The suffix is always inflectional, be it a nominal plural ending (e.g. [be:ɾə_], [bananə_], 'bears', 'bananas', the UoWorms variants of stD *beren*, *bananen*), or the pres. ind. ending 1st, 3rd plural for thematic verbs (e.g. UoWorms *vie²r wirrekə_* 'we work', *zie² lo:pə_*, 'they run' stD *wij werken*, *zij lopen*) or an ending of an adjective (e.g. UoWorms *ing gou²we_ oer*, stD *een gouden horloge* 'a golden watch', Luxembourg *gələn Auer* 'golden watch').¹⁵ In the

¹³ Deletion generally cannot take place after a consonant, e.g. Lux. *modern* 'modern' or *intern* 'internal'. Note that these post-consonantal final nasals occur only in a few loans or foreign words. Interestingly, inherited words with such a constellation have developed either the deletion of the nasal (Lux., UoWorms *kern* > *keer_* 'core'; UoWorms *gaarn(e)* > *geer_* 'voluntarily') or schwa epenthesis (Lux. *gern* > *gären* 'voluntarily'). This underlines a general ban on post-consonantal, final nasals.

¹⁴ Superscripts 1 and 2 indicate Accent 1 or Accent 2, respectively; cf. §3.

¹⁵ Unlike most (East-) Limburg dialects, the Ripuarian dialects and the dialects in the Ripuarian/East Limburg transition zone do not have -ən in Masc non-nominative determiners and their pronominal and

UoWorms and Eupen dialects all three suffixes today are lexically *n*-less. WFnD is thus lexicalized, i.e. the /n/ is absent in the lexical representation of the morpheme and there is no variation. In (3), these two varieties are contrasted with the Moselle Franconian varieties from Trier and Luxembourg, where WFnD can apply allophonically (cf. §5.2).

(3) Left-hand context {-ən}

UoWorms	Eupen	Trier	Luxembourg	
ma:kə_	ma:kə_	ma:xə n	ma:xə n	'to make'
lo:pə_	lo:pə_	la:fə n	la:fə n	'to run'
be:rə_	be:rə_	bəʁə n	biəʁə n	'bears'
yoʊwe_	γøldə_	gœlə n	gələ n	'golden'

If followed by schwa, in the UoWorms dialect (in almost all varieties of Dutch, for that matter) any final schwa is variably followed by a hiatus filler [n], hence e.g. [vie²r makə_n ət ʔs çəmy¹tliç], lit. we make it ourselves cozy, 'we make it cozy'. Similarly, Luxembourgish *wann s de [n] e fēnn*s 'when you find him', with a euphonic [n] filling the hiatus between two schwa's. This euphonic [n] before an initial schwa can appear where the final schwa is part of an (/n/-less) suffix, as for example [mɛə¹tjə-n-əm] 'girl him' (diminutive suffix -jə), [hyə¹γdə-n-əm] 'height him' (derivational suffix -də), [niə¹nɪfə-n-əm] 'seamstress him' (derivational suffix -ɪfə) and where the final schwa is part of a lexeme, as for example [ɾɪtmə-n-əm] 'rhythm him'; in these examples [-əm] is the cliticized form of the object pronoun /həm/.

This euphonic [n], which occurs variably as a connected (casual) speech phenomenon, is not the result of WFnD rule inversion - insofar as a rule can still be inverted in contexts where it has been lexicalized. It only occurs after schwa preceding an immediately following schwa. The latter part of the conditioning is hard to reconcile with the concept of an inversion of post-schwa final /n/ deletion.

5.1.2 Post-schwa, part of lexeme/stem {ən}

In a set of polysyllabic words final /ən/ is part of the lexeme and the nasal is treated differently compared to the inflectional suffix {-ən}. For the UoWorms dialects, examples of {ən} type words include:

(4) UoWorms	Standard Dutch	
te ² kə n	(ik) <i>teken</i>	'(I) sign' (1sg)
reə ² kə n	(ik) <i>reken</i>	'(I) calculate, (I) count' (1sg)
re ¹ ə n	<i>regen</i>	'rain' (N)
ze ¹ ə n	<i>zegen</i>	'blessing' (N)
re ¹ ə_	<i>reden</i>	'reason' (N)
te ² kə_	<i>teken</i>	'sign' (N)
la: ² kə_	<i>laken</i>	'sheet'
ver ² əkə_	<i>varken</i>	'pig'

relative counterparts. The latter /n/ is usually deleted, except if preceding a coronal obstruent or labial nasal or /h/. Cf. Kats (1985) for the Roermond dialect, Wetzels (1993) for the Schinnen dialect.

The finite verb forms [tekən] '(I) sign' (inf. [tekənə_]) and [reəkən] '(I) calculate' (inf. [reəkənə_]) can be argued to have zero suffixes; the 1sg forms are hence isomorphic with the verbal stems. In these and similar verbs, all inflectional endings are then attached to the ən# of the stem. This stem-final nasal is not deletable. The same applies to forms such as [re¹ən] 'rain', and [ze¹ən] 'blessing', resulting from the deletion of the etymological medial obstruent /ɣ/ which is present in the standard Dutch variants. In the remaining words, WFnD is lexicalized. In [re¹ə_], 'reason', an etymological medial /d/ has been deleted.

It becomes obvious from the examples in (5) that UoWorms and Eupen, where WFnD in this context has been lexicalized in an item-by-item fashion, hence lexically diffuse, again group together. In Trier and Luxembourg, however, the nasal is subject to deletion, despite the fact that in some words the nasal can be regarded as historically belonging to the stem followed by a zero suffix, as in the case of the imperative and the 1sg indicative forms. The latter two varieties thus make no difference between the contexts {-ən} and {ən}.

(5) Left-hand context {ən}

UoWorms	Eupen	Trier	Luxembourg	
(ich) reəkən	rekən	ræçnən	ræçnən	'(I) calculate' (1sg)
reəkən	rekən	ræçən	ræçən	'calculate!'
(ich) tekən	tekən	tse:çnən	tse:çnən	'(I) draw' (1sg)
tekən	tekən	tse:çən	tse:çən	'draw!'
tekə_	tekə_	tse:çən	tse:çən	'sign' (N)
verekə_	verəkə_			'pig'

In short, in the UoWorms and Eupen dialects in this linguistic context WFnD does not apply when schwa is part of a verb stem. For Trier and Luxembourg WFnD applies allophonically in all post-schwa contexts. These instances underline that the association of the nasal—either part of an inflectional suffix or part of the stem—can impose restrictions on its deletability.

5.1.3 Post long vowel or diphthong {Vn}

To begin with, the overview in (6) demonstrates that WFnD after a long vowel is largely blocked across most varieties. As a result, the majority of relevant nouns and adjectives featuring a pre-nasal long vowel or diphthong do not undergo WFnD. The gaps present in this overview (as well as in the subsequent ones) are the result of phonological developments that have altered the forms of the respective words, rendering them incompatible with this category.¹⁶ Notably, nearly all these words carry Accent 1, and the majority historically ended in a schwa, which was later lost due to apocope (e.g., Middle High German *bône* > Trier

¹⁶ These phonological developments, which have 'bled' WFnD in the various contexts, include vowel shortening, vowel lengthening, diphthongization, and velarization of [n] to [ŋ].

[bu:¹n] ‘bean’). It thus seems to be the case that WFnD is generally blocked after a long vowel carrying Accent 1.

(6) Blocking of WFnD after long vowel (non-exhaustive list)

UoWorms	Eupen	Trier	Luxembourg	Accent	
ha:n	ha:n	hə:n		1	‘rooster’
ʁRø:n	ʁRøyn	gri:n		1	‘green’
tʁo:¹n	tʁo:¹n	dri:n	tr3in	1	‘tear’
ti:¹n	ti:¹n	tʃi:n		1	‘ten’
	ny:n	na:n		1	‘nine’
bru:n	bru:n	brəʊn		2,1	‘brown’
		pa:n	pa:n	1	‘pan’
		ka:n	ka:n	1	‘jug’
ba:n	ba:n	bə:n		1	‘train/course’
fa:n	fa:n	fə:n		1	‘flag’
va:n		və:n	vo:n	1	‘car’
	lu:n	laʊn	laʊn	1	‘mood’
lu:¹n	lu:n	lu:n	ləʊn	1	‘wage’
bu:¹n	bu:¹n	bu:n	bəʊn	1	‘bean’

In contrast, WFnD is not restricted in two distinct, yet noteworthy groups of words, designated as {VVn_a} and {VVn_b}. The first group, {VVn_a}, presented in (7), consists exclusively of content words that exhibit either diffusely lexicalized WFnD (UoWorms), no deletion at all (Eupen and Trier), or variable deletion (Luxembourg).

(7) WFnD left-hand context {VVn_a} (exhaustive list)

UoWorms	Eupen	Trier	Luxembourg	Accent	
ʃte:_	ʃte:n	ʃta:n	ʃte:ɐ̯	2	‘stone’
be:_	be:n	ba:n	be:ɐ̯	2	‘leg’
	ʀe:n	ʀe:n	ʀe:ɐ̯	1	‘rain’
wi:n	vi:n	ve:ɪn	væ:ɐ̯	2	‘wine’
ʃjweɪn	ʃwam	ʃwe:ɪn	ʃwæ:ɐ̯	2	‘pig’
ʃji:n	ʃi:n	ʃe:ɪn	ʃæ:ɐ̯	2	‘shine; note’
fi:n, fein	fi:n	fe:ɪn	fu:ɐ̯	2	‘fine’

Despite their close linguistic relationship, it is particularly striking that Luxembourg consistently diverges in its application of WFnD, especially in comparison to Trier. Unlike the previous group in (6), these words predominantly contain (historical) front vowels or diphthongs (i.e., [i:, e:, ai, æ:ɪ], the latter two having evolved from historical [i:]), and in all but one case, they exhibit Accent 2. These features contribute to their classification as a relatively homogeneous lexical group, in which Luxembourg is the only variety that permits (allophonic) WFnD.

The remaining words in the {VVn} context, summed up in (8), consist primarily of high-frequency items, most of which are function words (e.g., articles, pronouns). The words of this subset (labeled as {VVn_b}) are often unstressed and, as a result, more prone to phonetic reduction and connected speech processes. The only content words in this subset are the high-frequency adjectives meaning ‘small’ and ‘pretty.’ Similar

to the {VVn_a} context, deletion is predominantly lexicalized in UoWorms and Eupen. In contrast, allophonic WFnd consistently occurs in Trier and Luxembourg. Notably, most of these words also exhibit Accent 2.

(8) WFnd left-hand context {VVn_b} (exhaustive list)

UoWorms	Eupen	Trier	Luxembourg	Accent	
e:_	e:n	a:ʰ	e:ʰ	2	'one/a (full form)'
ye:_		ka:ʰ	ke:ʰ	2	'no-one'
		dɛ:ʰ	de:ʰ	1	'the/this' (dem.)
a:_		ɔ:ʰ		2	'on'
mi_	mi_	maɪʰ	mæ:ɪʰ	2	'my' (masc./neut.) ¹⁷
di_	di_	daɪʰ	dæ:ɪʰ	2	'your' (masc./neut.)
zi_	zi_	zaɪʰ	zæ:ɪʰ	2	'his' (masc./neut.)
		hɛ:ʰ	hiəʰ	2	'he'
		vɛ:ʰ	viəʰ	2	'who'
kle_	klai_	kla:ʰ		1	'small'
fu:n ¹⁸	fu:n	fi:ʰ	fɜiʰ	1	'pretty'

In conclusion, allophonic WFnd after a long vowel is possible only in Trier and Luxembourg, and even then, it is restricted to a small subset of content words that historically contained a front vowel and/or Accent 2 ({VVn_a}), as well as a few high-frequency words ({VVn_b}). For all other words within the {VVn} category, WFnd is generally unattainable, particularly for those with a historical back vowel and/or Accent 1. Overall, for {VVn}, the type of Accent appears to be a strong determining factor.

5.1.4 Post short vowel {Vn}

For the context following a short vowel it is again necessary to distinguish two groups of words. In a specific set of monosyllabic items with a short vowel WFnd occurs either variably (UoWorms, Eupen) or allophonically (Trier, Luxembourg); the set includes prepositions, articles, the weak forms of the pronoun 'he', the conjunction 'and', adverbs and certain high-frequency verbs, including auxiliaries and modal verbs. If properly stressed, some items have Accent 1, others Accent 2, yet others either of the two. Although they are in principle stressable, all these words occur predominantly without phrasal stress.

(9) WFnd left-hand context {Vn} (exhaustive list)

UoWorms	Eupen	Trier	Luxembourg	Accent	
vɔʰ	vɔʰ	fɔʰ	fuʰ	2	'of'
ɪʰ	ɛʰ	oɛʰ	ɑʰ	2	'in'
		dɔʰ	dɔʰ		'the' (m.) (red.)

¹⁷ For this and the next two possessive pronouns, the form shown is for the varieties of UoWorms and Eupen that used for sg. neuter nouns (referring to the possessed) and for the varieties of Trier and Luxembourg that used for sg. masculine and neuter nouns. Besides, in UoWorms and Eupen the three forms do not have any tonal accent.

¹⁸ The UoWorms forms [kle_] and [fu:ən] occur exclusively as inflected attributive forms with sg. neuter nouns.

	ən	ən	ən		'a' (m./n.) (red.)
		ən	ən		'he' (red.)
ɑn	ɑn		un	1	'on'
ɛn	ɛn	on	ɑn	2	'and'
dan	dan	dan	dan	2	'then'
		van	van		'when'
		ʃon	ʃon		'already'
nu	no_			2	'now'
hin		hi	hi	1	'to'
bi	bi	zə	zi	1	'(I) am'
ha	ha	ha	hu	1,2	'(I) have'/'to have'
go			gi	1	'(I) go'
do	do	di	di	1	'(I) do'
ka	ka	ka	ka	1	'can' (sg 1,3)
		ge	gi	1	'to give; to become'
za				1,2	'(I) say'
zi	ze		gəzi	1	'(I) see'
ki	ke			1	'to know so.' (sg1,3)
kri	kri_			1	'(I) get'
ʃto	ʃto	ʃti	ʃti	1	'(I) stand'
ʃlon	ʃlo			1	'(I) beat; (I) hit'

The last six verbal forms in (9) cannot, of course, be considered as function words, but they are high-frequency items. Note that these words are also often in unstressed phrasal position. Especially in the latter respect, this exhaustive set forms a consistent group of words.

All remaining words with a short vowel will never allow WFnd. The following set is not exhaustive and contains examples for nouns and adjectives (10a), inflected verb forms (1sg, pres.indic. and imperative: 10b), and proper names (10c), and hence no function words. Furthermore, none of the forms in (10a-c) can be considered as a high-frequency item. The same applies for the affixes *on-* and *-in* (10d). At least for *on-*, this is remarkable since this particular prefix (like many prefixes with a full vowel) constitutes an autonomous phonological word, unlike the suffix *-in*. In contrast to the prepositions *in*, *an* presented in (9), which show deletion also in particle verbs (UoWorms [ɪ_dɔjə] 'to press in', lux. [a_pa:kən] 'to wrap up'), the prefix *on-* in formations such as (10d) cannot undergo WFnd at all.

(10) Blocking of WFnd after short vowel (non-exhaustive list)

(10a) Nouns and adjectives

UoWorms	Eupen	Trier	Luxembourg	
kan	kan			'jug', 'pitcher'
dən	zan	dan	dæn	'pine tree'
dən		dən	dæn	'threshing-floor'
ɪn	oen		ən	'onion'
		zœn	zæn	'sin'
zɔn	zon	zon	zon	'sun'

h ə n		hun	hun	'chicken', 'rooster'
t ə n	ton	ton	ton	'barrel'
		man	man	'man'
d y n	doen	doen	dən	'thin'
		blan	blan	'blind'

(10b) Verbal forms

	n e n	n e n	næn	'name!' (imp.)
r e n	r e n	r e n	ræn	'run!' (imp.)
v i n	yeven	win	wan	'win!' (imp.)
γ y n	γ ø n	g e n	gæn	'indulge!' (imp.)

(10c) Proper names

An, Jan, Ben, Ien, Fien, Mien, Tien, Ton, Ron, John; Ian, Linn, Finn, Jeanne ...

(10d) Affixes

		on-gut	on-gutt	'not good'
on-rech(t)	On-reet	On-rächt	On-recht	'injustice'
		Enkel-in	Enkel-in	'grand-child' (f.)

The above words in (9), which do allow variable or allophonic WFnD, share key traits: they may but do not necessarily attract phrasal stress or carry an Accent. Most are function words, including prepositions, articles, pronouns, conjunctions, auxiliaries, and modal verbs, which explains their stress variability, while none, except lexical verbs, function as lexical heads. In contrast to the words in (10), those in (9) thus frequently appear in prosodically weak positions, exhibit inconsistent phrasal stress behavior, and, when unstressed, cannot bear an Accent, causing /n/ to lose its tonal function — factors that ultimately contribute to WFnD. These structural properties explain also why, e.g., in Trier and Luxembourg the article *dən*, 'the' (masc.), is subject to WFnD while the homophonous adjective *dən*, 'thin', never allows WFnD (similarly: UoWorms *kan* '(I) can' vs. *kan* 'jug'). The same seems to apply to the Trier und Luxembourg form *ən*, 'he'.

5.1.5 Underlying representations

Surveying the patterns in 5.1.1 to 5.1.4, we can distinguish four scenarios:

a. no deletion – as in the case of the Eupen and Trier variants of {VVn_a} words such as, e.g., *ftam* and *fta.n*, 'stone', or *fi.n* and *fam*, 'fine';

b. deletion lexicalized – e.g. {-ən} UoWorms, Eupen. As in the case of the lexically n-less variant of the morpheme -ən, e.g. *makə* 'to make', or *beɾə* and *be:ɾə*, 'bears';

c. deletion lexicalized – item-by-item e.g. {ən} UoWorms, Eupen; some words are n-less (*tekə* and *taikə*, 'sign' (noun);

d. post-lexical deletion: d1. variation e.g. {Vn} UoWorms, Eupen, or d2. allophony e.g. Trier, Luxembourg. Here the UoWorms and Eupen variants show variable WFnD,

while the Trier and Luxembourg variants show allophonic WFnd (e.g. *haʔ*, *haʔ*, *haʔ* and *huʔ* respectively, ‘(I) have’).

At the level of the underlying representation (UR, input to the phonological grammar), the four scenarios can be reduced to three types (12):

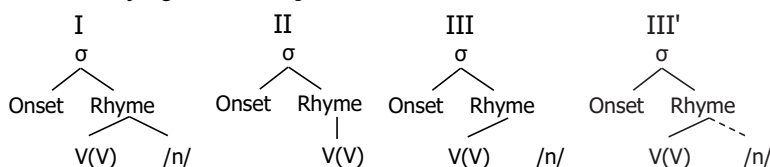
I n-full (scenario a),

II n-less (scenarios b, c),

III /n/ is lexically present, but not prosodically anchored (scenario d). Here the /n/ is ‘floating’ or ‘untimed’.

Since lexicalisation of WFnd means that there is no longer an /n/ in the UR, we could look at variable and allophonic WFnd as UR’s where /n/ is present, but not anchored:

(12) Underlying (lexical) representations¹⁹



In III, the /n/ in the rhyme is lexically present, but not linked to any higher prosodic structure. Depending on the right-hand environment (Trier, Luxembourg) it will or will not be linked and thus phonetically realized. This linking process is represented in III'. For the UoWorms and Eupen dialects, the conditioning is not structurally determined, but stochastic. In the first case study to be presented in §5.3 we will try to unearth the conditions that add to the chances of /n/ to be realized in 20 dialects of the Riparian/Riparian-East Limburg group, including the ones spoken in UoWorms and Eupen.

The proposal to consider /n/ in type III as underlyingly present but prosodically unlinked brings out the non-gradient nature of allophony and variability: there are only two possible outputs and not an endless series of intermediate variants.

Representations II and III evidently result from WFnd, more specifically from lexicalized WFnd and from post-lexical WFnd which is in the process of eroding final /n/, respectively. In type III, the UR is in the process of undergoing change, in II the UR has been changed. For contexts where WFnd is no longer productive, its lexicalisation can result in forms of type II (e.g. the inflectional morpheme $-\text{ən} \rightarrow -\text{ə}_\text{}$). Where the lexicalisation proceeds diffusely, the endpoint of III is either II (e.g. $[\text{re}^1\text{ə}_\text{}]$, ‘reason’ in UoWorms; $[\text{ʃte}^2\text{ }_\text{}]$, ‘stone’, in UoWorms) or I (e.g. $[\text{re}^1\text{ə}\text{n}]$, ‘rain’, in UoWorms; $[\text{wi}^2\text{n}]$, ‘wine’ in UoWorms).

5.2 Right-hand environment and prosodic conditions

While the segmental setup of the left-hand side only determines which words can undergo WFnd in the first place, it is the right-hand segmental environment together

¹⁹ With the exception of the syllable-internal structure, all irrelevant structure has been omitted.

with related prosodic conditions which are decisive for WFnD to apply or not. More specifically, the type of prosodic boundary and the initial segment of the following word come into play here. The following discussion is organized along the prosodic hierarchy (Selkirk 1978/1981; Nespor & Vogel 1986) and progresses from the phonological word upwards to the utterance level. Hinskens (1992; 2009) and Gilles (2014) have shown that the lowest prosodic level for WFnD to occur is not the syllable level, but rather the level of the phonological word.

The following analysis will concentrate on type III, i.e. post-lexical (variable or allophonic) WFnD. For the UoWorms and Eupen dialects this concerns the context {Vn} while for the Trier and Luxembourg varieties it concerns the contexts {-ən, Vn, VVn_a, VVn_b}, disregarding {ən} due to low lexical incidence. Contexts in which WFnD cannot apply and the cases of historically lexicalized deletion (hence types I and II) will not be considered further.

5.2.1 WFnD at the boundary between phonological words: $\text{[}\text{ɐ}\text{]}\omega\text{ }\omega\text{[}$

5.2.1a Non-cliticized environments. Certain properties of the initial segment of the following phonological word ω constitute strong blocking conditions on WFnD. In its most categorical form, this condition is encountered in Moselle Franconian and is well known in dialectological literature since the mid-19th century, described e.g. for Luxembourgish by Meyer (1845:XIV) and Klein (1855:17). Later the phenomenon has become known as the ‘Eifler Regel’ (lit. ‘Eifel Rule’,²⁰ Büsch 1888, Capesius 1966, Ternes 2017), ‘bewegliches -n’ (‘mobile n’, Bruch 1953:143, 1954:25ff.), ‘n-Tilgung’, (‘n deletion’, Gilles 2006) or ‘n mobile’ (Newton 1990:165f.). Specifically, WFnD is blocked when followed by a vowel, /h/, or any coronal stop consonant, including /d, t, ts, n/. Deletion occurs only when these conditions are not met, that is, when the following segment is either a non-coronal consonant (/m, p, b, f, v, k, g, ʀ, j/) or a coronal continuant (/s, z, l, ʃ, ʒ/). It is important to note that this process operates as a rule of external sandhi and, consequently, deletion can only occur if a phonological word immediately follows. Any intervening pause or hesitation will block WFnD. Given that this structural analysis categorizes the right-hand environment into two distinct segmental classes—those that prohibit and those that allow deletion—this process is termed here as ‘allophonic deletion.’ In the first case, WFnD is excluded; in the second case, WFnD is obligatory.

A phonological interpretation of these blocking conditions within the framework of feature geometry has been provided by Gilles (2006) and Hinskens (1992:339; 2009). It is argued that the phenomenon is governed by the integration of the nasal into the syllable onset of the following word. If the nasal can be incorporated into the onset of the following phonological word, WFnD is blocked. This process involves two primary cases: (1) when the following word begins with a vowel or with /h/²¹, the nasal of the preceding word is resyllabified into the onset of the subsequent word; (2) when the following word begins with a coronal stop consonant such as /d, t, ts, n/, the oral cavity features of the

²⁰ Eifel is the toponym for the region, covering a larger part of the Moselle Franconian area.

²¹ The inclusion of /h/ among the segments that block WFnD lacks a fully convincing phonological or phonetic explanation. Since /h/ does not pattern with coronal stop consonants, the most plausible classification at present is as a voiceless vowel (Laver 1994:304f.), which would permit resyllabification in a manner similar to vowels. However, a comprehensive acoustic-phonetic analysis is required to substantiate this provisional hypothesis.

stop are shared with the preceding /n/, creating ‘partial gemination’ (cf. Hayes 1986) in sequences such as /n d/, /n t/, /n t͡s/ (and also the ‘true geminate’ /n n/²²). Through these linking mechanisms, the final /n/ becomes phonologically associated to the following word and since it is not in absolute word-final position, WFnD cannot apply. If none of these conditions is met, the nasal remains unlinked in the phonological representation and will not be realized phonetically.

The examples in (13) show for the contexts {-ən}, {Vn} and {VVn_b} how WFnD is reacting in the expected allophonic way at the boundary with the following phonological word.

(13) Allophonic WFnD at the boundary of phonological words in Luxembourgish

	before vowels or /d, t, t͡s, n, h/	elsewhere
{-ən}	ʃʁaivən] _ω [di:v ‘writing you’	ʃʁaivə] _ω [ba:l ‘writing soon’
{Vn}	gin] _ω [di:v ‘giving you’	gi] _ω [grəʊs ‘becoming big’
{VVn _b }	mæ:m] _ω [dɔf ‘my table’	mæ:ɪ] _ω [bus ‘my bus’

A specific kind of variation arises for {VVn_a}: While the blocking conditions for WFnD remain intact here, i.e. the nasal is always present before vowel or /d, t, t͡s, n, h/ (be:n]_ω [t͡sɪɪn, but never *be:ɪ]_ω [t͡sɪɪn), the nasal can occur *variably* elsewhere (14).

(14) Variable WFnD with one-sided allophony for {VVn_a}

	before vowels or /d, t, t͡s, n, h/	elsewhere
{VVn _a }	be:n] _ω [t͡sɪɪn ‘pull leg’	be:n] _ω [gəbrax ‘leg broken’
		be:ɪ] _ω

Thus, for {VVn_a}, the allophony is partially dissolved in the sense that one side of the allophony remains obligatory, i.e. WFnD blocked before vowel, /d, t, t͡s, n, h/, while the other side shows variable WFnD. In this constellation, WFnD is in an intermediate position: it is still partly variable (phase 2) while already displaying obligatorily allophonic behaviour in certain contexts (phase 2’ in the life cycle). This transitional type of the process can be described as *variable WFnD with one-sided allophony*.

The same array of blocking conditions applies to the dialect of Trier and to the entire Moselle-Franconian region. The maps in the MRhSA demonstrate this for some instances of the {-ən} words (MRhSA 1995–2002, maps 440 and 442). Further north in the heartland of the Ripuarian dialect area, e.g. in Cologne, the blocking condition is nearly identical, but its application is lexically restricted to some function words of the {-ən} and {VVn_b} groups only, i.e. the neuter forms of the indefinite article /ən/ and of the possessive pronouns /mi:n/, di:n/, zi:n/: [ən hu:s] ‘a house’ vs. [ə_ kiŋk] ‘a child’, [mi:n hu:s] ‘my house’ vs. [mi:_ kiŋk] ‘my child’ (cf. Münch 1904:140, 162). The article is procliticized and hence not an autonomous phonological word (so strictly speaking it should feature in §5.2.1b, that concerns encliticized structures), but the

²² Most current descriptions (but not, e.g., Bruch 1954, Newton 1990) include also word initial *n-* into the rule specification. Thus, WFnD will not occur, e.g., in *en Nol* ‘a nail’. However, in a further post-lexical process, the resulting geminate [ən:o:l] is phonetically mostly reduced to a singleton [əno:l].

possessive pronoun is not necessarily so. In Cologne WFnD is not blocked, but rather allophonic in the indefinite article and the neuter possessive pronouns.

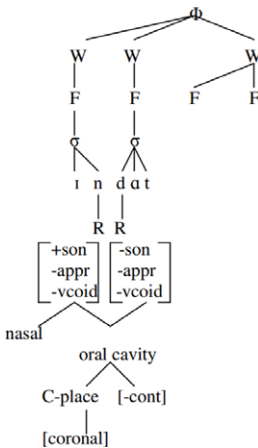
In the western part of the Ripuarian/East-Limburg dialect area, e.g. in Eupen and UoWorms, WFnD still displays the interaction of the final nasal with a following voiced coronal plosive, described above, but the blocking conditions are more restrictive in two respects. Specifically, WFnD is blocked for {Vn} words only. And it is also more restricted with respect to the right-hand environment, as deletion is blocked only when the following word begins with the voiced coronal stop /d/, and is not a lexical head, such that /n/ and /d/ are within the same phonological phrase. So, for example, WFnD is blocked in constellations such as those in (15), where /n/ and /d/ share features such as [voice] and [coronal] and where they are within the same phonological phrase.

(15)

UoWorms	m dat filia:l	'in that branch [of a store]'
Eupen	en de petʃ	'in this deep water' (Tonnam & Evers 1899:140)
	en dɐ ti:t	'in those days' (Tonnam & Evers 1899: 201)

Analyses of this and similar data reveal that in case the following word has an initial /d/, WFnD is allowed if and only if the following word is a lexical head, thus heading a phonological phrase. This is not the case in the structure in (16), for constellations such as those in (16):

(16) Featural representation of a 'partial geminate'



In short: In Eupen and UoWorms, WFnD is blocked if /n/ is involved in partial gemination within a phonological phrase.

Interestingly, in UoWorms non-inflectional [n] occurs obligatorily in e.g.

- (17) i-**gen**-dörp²³ 'in the village'
 oet-**gen**-dörp 'out of in the village'
- va-**gen**-tokes 'from the butt'
 oet-**gen**-tokes 'out of the butt'
- i-**gen**-hoes 'in the house'
 va-**gen**-hoes 'from the house'
 oet-**gen**-hoes 'out of the house'
- va-**gen**-Ing 'from the End'²⁴
 oet-**gen**-Ing 'from/out of the End'

Here [n] is euphonic, i.e. not part of the UR and added phonetically. It is inflectionally wholly unexpected, given the fact that *dörp* and *hoes* are neuter nouns, which would otherwise require the *ge* (rather than the *gen*) allomorph of this particular determiner, which can only follow certain prepositions (Hinskens 2007:78–79; similarly for Eupen, vid. Tonnar & Evers 1899:5–6). In the case of neuter nouns which do not have an initial coronal obstruent, /h/ or vowel, the *gen* allomorph of the determiner is unwellformed and only *ge* can be used:

- (18) i-*ge*-veld 'in the field'
 * i-*gen*-veld
 i-*ge*-bed 'in(to) the bed'
 * i-*gen*-bed

gen and its allomorphs *gene* (/ʎənə/, Masc sg) and *ge* (/ʎə/, n sg) are archaic and have been fossilized in these and similar contexts, following certain directional or positional prepositions – where the generic determiners (definite articles) have taken over. The archaic syntagms with *ge(n(e))* seem to be the only vestiges of the blocking of WF_nD preceding another segment than /d/, as still applies in the Moselle Franconian dialects.

5.2.1b Impact of encliticization. While cliticization as such occurs in all four varieties, it is only for the UoWorms and Eupen varieties that it affects WF_nD. In these two varieties the deletion is blocked in constellations such as

- (19a) Ich kan 't 'I can [do] it'
 [kanət]

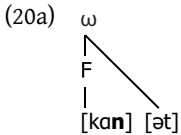
it is not blocked, when the following word is not a clitic, e.g.

- (19b) Dat ka(n) ich 'That can I [do]'
 [kan iç]

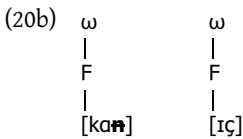
²³ Phonetically [ʎɪʏəndœːʔəp].

²⁴ A local quasi micro-toponym.

The difference between schwa and other vowels²⁵ in the right-hand context suggests that WFnD is blocked because the following word has a reduced vowel, schwa. As a word cannot have a schwa initially, it gets incorporated into the target word. Whereas the prosodic structure of the relevant part of (19a), where WFnD is blocked, is



in the case of (19b), it is



The /n/, it appears, can only be deleted in phonological word-final position. WFnD is hence blocked before a schwa-initial enclitic element (cf. Hinskens 1992:§8.4.4).

On the other hand, for Trier and Luxembourg cliticization as such is not a decisive factor for WFnD: whether a word (e.g. article or pronoun) is enclitic or not does not impact on the deletability of the preceding nasal (lux. *Ech [kan da:t]_{full}* vs. *Ech [kan ət]_{enclitic}* ‘I can [do] it’). By the same token, in a structure like (20b) WFnD is blocked in the Trier and Luxembourg varieties). Rather, allophonic deletion applies across the board, thus overruling eventual cliticization.

5.2.2 WFnD at the boundary between phonological phrases: $\text{ɲ} \varphi \varphi$

The phonological phrase constitutes the next higher prosodic domain relevant to the discussion of WFnD. For UoWorms the blocking before /d/ mentioned in §5.2.1a occurs phonological phrase internally, but not at the boundary between phonological phrases. This is exemplified in (21a), where WFnD applies variably, as it does in cases where the phonological phrase boundary is followed by another segment, as e.g. in (21b):

- (21a) Ich dink dat ich nit sjlooape $\text{kan} \text{ɲ} \varphi \varphi$ [durch dea kaffe].
 ‘I think that I can’t sleep through [i.e. because of] that coffee’
- (21b) Ich dink dat ich boekpieng krien $\text{ɲ} \varphi \varphi$ [van dat eeate].
 ‘I think that I get a pain in the stomach from that food’

²⁵ In varieties of Dutch, a pronoun such as *ik* [ɪk] or *ich* [ɪç], ‘I’, can serve as a phonological word of its own, as it contains a full vowel. Cf. Booij (1995:166–169).

For Luxembourg and Trier the conditions are the same for the boundary between phonological phrases and allophonic WFnd for the left-hand contexts $\{-\text{ən}, \text{Vn}, \text{VVn}_b\}$. By contrast, in $\{\text{VVn}_a\}$ the variable deletion rate is much lower. In instances like (22), where a $\{\text{VVn}_a\}$ word precedes the boundary of a phonological phrase φ (i.e. the prepositional phrase *beim Iessen*), WFnd occurs only in 30 % of the cases (cf. (26) in case study 2 in §5.3).

- (22) Ech drénke just ee Glas Wäin_a]_ω]_φ φ_ω[beim Iessen.
 'I am drinking only one glass of wine for my meal.'

Thus, across phonological phrase boundaries, WFnd in $\{\text{VVn}_a\}$ is increasingly blocked compared to lower levels of the prosodic boundary.

5.2.3. WFnd at the boundary between intonational phrases: $\#$]_I , [

Intonational phrase-final WFnd is variable in UoWorms. The following examples (23) from UoWorms illustrate, however, that different degrees of acceptability might apply.

- (23) ?]_I [Wen ich dizzen ovvend nit mit [y_{on}],]_I]_I [gees doe da(n) ooch nit?]_I
 'If I this evening not with go, go you then also not'
 'If I don't go tonight, won't you?'
]_I [Wen ich dizzen ovvend hi-j [bi_n],]_I]_I [kumps doe da(n) ooch?]_I
 'If I this evening here am, come you then also'
 'If I'm here tonight, will you come too?'
]_I [Wen ich dizzen ovvend nit goa [ka_n],]_I]_I [kans doe da(n) ooch nit?]_I
 'If I this evening not go can, can you then also not'
 'If I can't go tonight, can't you?'

For the Eupen dialect, there is no evidence concerning WFnd at the boundaries between phonological and intonational phrases; the situation is better for immediately neighboring dialects. From the transcriptions of the RND data, it appears that /n/ in relevant $\{\text{Vn}\}$ words was either realized or not realized in each of the 34 contexts (studied for case study 1 in §5.3). When realized, it is not straightforward whether /n/ can be variably deleted in a specific context. The only sure indication of deletability is when an /n/ is not realized. In the transcriptions for the dialect of Raeren, there is deletion (in *han*, '(I) have') before a phonological phrase boundary (sentence 14 in the RND questionnaire), in the transcriptions of the dialect of Lontzen in *kan* '(I) can') before a phonological phrase boundary (sentence 73) and in the transcriptions of the dialect of Walhorn in *han* ('have (inf)') before an intonational phrase boundary (sentence 44). From the fact that the /n/ is realized in the relevant sentences in dialects of this subgroup other than those mentioned (all spoken in a relatively small area – see the map in Fig. 2 in §5.3), we dare to infer that /n/ is variably deletable in these prosodic contexts in all dialects of this small area.

For Luxembourg and Trier, WFnd is possible only under certain circumstances. In general, WFnd is blocked whenever the boundary between intonational phrases is realized with a pause or another heavy prosodic break. However, if a pronounced prosodic break is absent (i.e. if there is no pause) and the second intonational phrase is immediately latched to the first one, WFnd applies. Remarkably, in the contexts $\{-$

ən, Vn, VVn_b}, as in (24a), deletion is not allophonic as before, but rather highly variable, while it is entirely blocked after preceding VVn_a, as in (24b).

- (24a) ₁[Et wier schéi~~n~~,]₁ ₁[wann ech deng Händsche krit.]₁
 ‘it would be nice, if I could get your gloves’
- (24b) ₁[Ech kréie mäi Führerschäin,]₁ ₁[wann ech al genuch sinn.]₁
 ‘I will receive my driving license, when I am old enough’

5.2.4. Utterance-final: ə]_U

Utterance-finally, WF_nD occurs variably in UoWorms and Eupen; see the following example (25) from the RND survey (in italics the Standard Dutch variant the informants translated into their dialects).

- (25) *Die peer is niet rijp; daar zit nog een witte pit in*, ‘That pear is not ripe; it still has a white stone in it’ (RND sentence #36, Waubach/UoWorms Q 117a).

In the transcribed dialect version in the questionnaire for UoWorms this is ₁]_U (‘inside’):

*de.ɪ bi.ʁ is nɪt ri:p dɔ.ə xɪt nɔgən
 wɛtə ke.ə ɪ*

For Eupen the same applies (*dre_]_U* ‘there inside’):

*de.ɪ pe.ə ɛs nɔx ni:t ki:p - dazɪt nɔgənə
 wɛtə kɛ.ɛ rɔ dɛɛ.*

For Luxembourg and Trier, on the other hand, WF_nD is entirely blocked utterance-finally.

5.3 Case Studies

Case Study 1:. Variation in WF_nD following a short vowel in 20 Ripuarian and Ripuarian-East Limburg dialects

In §§5.1.4 and 5.1.5 it has become clear that WF_nD after short vowels in UoWorms and Eupen is variable, while in Trier and Luxembourg it is obligatory and allophonic – although it is thus post-lexical and representationally of type III in both dialect groups.

What are the conditions that determine the probability of WF_nD to apply in UoWorms, Eupen and other dialects in the Ripuarian area and the Ripuarian/East-

Limburg transition zone? This question has been studied through the statistical analysis of variable WFnd in monosyllabic function (and some high frequency) words with a short vowel for the 20 relevant local dialects of Ripuarian and the Ripuarian-East Limburg transition zone in the Netherlands and neighboring areas in northeastern Belgium. The transcriptions of these data are online.²⁶ The data are from the *Reeks Nederlandse Dialectatlassen*, 'Series of Dutch Dialect Atlases' (vid. §2.1); they were collected in the late forties of the last century, and they concern 34 tokens (9 types, elicited through 29 different sentences) per single dialect. The map in Figure 2 shows the research area, with the local Ripuarian dialects marked red and those in the transition zone Ripuarian-East Limburg marked green.



Figure 2. The location of the 20 relevant dialects. Red: Ripuarian dialects, green: dialects of the transition zone. Waubach is the main historic core of Ubach over Worms.

²⁶ <https://www.dialectzinnen.ugent.be/transcripties/belgisch-limburg-en-zuid-nederlands-limburg/>.

Last visited 20.3.2025.

Table 4a. Outcomes of a mixed models logistic regression analysis

Fixed effects				
	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	−4.3499	0.7730	−5.627	1.83e-08 ***
##coronal C ²⁷	1.2253	1.0030	1.222	0.221826
##non-coronal C	4.6646	0.8356	5.583	2.37e-08 ***
#utterance boundary	1.3681	0.9459	1.446	0.148071
Accent 2	3.3835	0.8163	4.145	3.40e-05 ***
##phrase boundary	0.1289	0.8258	0.156	0.875999
frequency of usage	−1.2379	0.3466	−3.572	0.000354 ***

Table 4b. Summarizing the main outcomes

Extra-linguistic	significant effect?
country	no
dialect group	no
Linguistic	
right-hand segmental environment	yes
potential Accent	yes
grammatical class	no
+/- before boundary prosodic domain	no
Cognitive (lexical effects)	
frequency of usage ²⁸	yes

The outcomes of the multivariate analyses (mixed-model logistic regression; random effects: dialects, items; optimal model) are shown in Table 4a; Table 4b summarizes the main findings. Remarkably, the extra-linguistic factor groups as well as the linguistic factor group ‘grammatical class’ are not even included in this modelling, meaning that the analysis was unable to attribute any variation to these factors.

At the overall level (all 20 dialects) there are only few statistically significant effects. As to the nature and directions of the significant effects:

²⁷ #(#x means: before a word boundary followed by x.

²⁸ The frequency of usage of the 9 items is based on independent data from the 11-million-word *Corpus Gesproken Nederlands*, ‘Corpus Spoken Dutch’ (raw counts for ‘woordvorm’, i.e. forms, not lemmata; numerical data not log-transformed).

- for the factor right-hand segmental environment, non-coronal consonants turn out to have a positive effect on deletion chances. This underlines that in these dialects variable WFnD in monosyllabic function words with a short vowel has properties of post-lexical processes;
- for the factor Accent: words with a potential²⁹ Accent 2 have a higher chance of undergoing WFnD than words with a potential Accent 1;
- the factor frequency of usage has a negative effect: the higher the frequency of usage, the smaller the chance for WFnD to apply. This is hence not a phonetic reduction effect, but maybe rather what Bybee (2001; 2006:715) has coined the ‘Conserving Effect’, the resistance to analogical change, as e.g. in the conjugation of high-frequency strong and irregular verbs.

WFnD is hence sensitive to the right-hand segmental environment. It is also sensitive to two lexical properties; like token frequency, the difference between Accent 1 and Accent 2 is lexical, since it cannot be derived from anything independent. The fact that there are post-lexical as well as lexical effects indicates that WFnD in these dialects oscillates between post-lexical status and hesitant incipient lexicalization. Thus, it seems that in this dialect group, for words of the type in (9), the process is moving towards the next stage in the life cycle.

Case Study 2: Sensitivity of WFnD to prosodic boundary in Luxembourg

In §5.2.3 it has been shown that in Trier and Luxembourg words of the {VVn_a} class are subject to variable WFnD, as opposed to allophony in the other left-hand contexts. For Luxembourgish, these variable cases have been addressed in a recent crowd-sourced data collection (Entringer *et al.* 2021). The results for five {VVn_a} words followed by gradually differing prosodic boundaries are presented in (26): compound, phonological word and phonological phrase.

(26) WFnD of {VVNn_a} words at different prosodic boundaries

prosodic boundary	{VVn _a }	% WFnD (N speakers)
phonological word first member of compound	ω[Wäi _n] _ω ω[fläsch] _ω 'wine bottle'	87 % (234)
phonological word	Ech sinn iwvert e ω[Ste _n] _ω ω[gefall] _ω . 'I fell over a stone.'	54 % (300)
phonological word	Si huet sech e ω[Be _n] _ω ω[gebrach] _ω . 'She had broken her leg.'	49 % (1085)
phonological word	De ω[Re _n] _ω ω[geet] _ω mir op d'Nerven. 'The rain is getting on my nerves.'	32 % (557)
phonological phrase	Wäi _n] _ω φ φ[ω[beim lessen 'wine while eating'	30 % (950)

²⁹ As was pointed out in §3, the Accents can only be realized if there is sufficient substance (at least two moras) and if the syllable bears primary word stress.

From the percentages, it is obvious that the application of WFnd is correlated with the strength of the boundary: for the boundary between the phonological words constituting a compound like *Wäinfläsch*, ‘wine bottle’, the percentage is very high, indicating near-categorical allophony.³⁰ However, the percentages for the boundaries between autonomous phonological words or between phonological phrases are much lower. The overall picture is one of variation. By going down to only 30% WFnd for the phonological phrase, it becomes obvious that higher order prosodic boundaries exert stronger blocking conditions for WFnd in Luxembourgish.

The mixed-effects logistic regression model in Table 5 demonstrates a strong effect of prosodic structure on WFnd. Compared to compounds, the probability of deletion drops dramatically at higher prosodic levels: in phonological phrases the odds of WFnd are reduced by about 97% (OR = 0.03, $p < 0.001$), and in phonological words by 90% (OR = 0.10, $p < 0.001$). This pattern indicates that WFnd is much more likely in compounds and becomes increasingly unlikely for higher prosodic domains. The model’s conditional R^2 of 0.336 further shows that both prosodic boundary type and variability across speakers and words contribute meaningfully to explaining the occurrence of WFnd.

Table 5. Logistic mixed-effects regression model

Predictors	WFnd (Logistic Mixed-Effects Model)		
	Odds Ratios	CI	p
(Intercept)	8.18	3.60 – 18.57	<0.001***
Prosody: Phonological Phrase vs. Compound	0.03	0.01 – 0.09	<0.001***
Prosody: Phonological Word vs. Compound	0.10	0.04 – 0.24	<0.001***
Random Effects			
σ^2		3.29	
τ_{00} speaker		0.78	
τ_{00} word		0.13	
ICC		0.22	
N _{speaker}		1848	
N _{word}		5	
Observations		3257	
Marginal R^2 /Conditional R^2		0.152/0.336	

Model: WFnd ~ prosody + (1 | speaker) + (1 | word)

³⁰ A compound, although also made up of two or more phonological words, is characterized by a different prosodic structure than two adjacent non-compound phonological words. In the heavily grammatical boundary-based SPE notation (Chomsky & Halle 1968), this understanding had its parallel in the use of one (#) and two grammatical word boundary symbols (##) respectively. For the justification of ‘recursive phonological words’ within compounds cf. Nespor & Vogel (1986: xvii) or Ito & Mester (2021).

6. Wrapping up: linguistic conditioning of WF_nD

For the state of affairs regarding the complex phenomenon of WF_nD in the four traditional varieties studied, the following types of linguistic conditioning have been shown to apply. They all contribute(d) to the diachronic unfolding of the phenomenon and to its dialectological diversity.

- *segmental*
 - the segmental and grammatical nature of the left-hand environment: lexical schwa/morphemic schwa/full short vowel, full long vowel;
 - the segmental nature of the right-hand environment: vowel, /h/, coronal consonant, non-coronal consonant;
 - *suprasegmental*
 - phrasal stress: The fact that WF_nD is found predominantly in unstressed or unstressable contexts, function or high-frequency words as well as in schwa syllables, underlines the phonetic naturalness of the process and reflects its phonological embedding in the prosodic hierarchy;
 - The actual or potential Accent. Crucial is the question whether final /n/ is related with an Accent. If so, then there are at least two moras and the syllable can have either Accent 1 or Accent 2, provided the syllable carries word stress. Final /n/ is related with an Accent whenever it follows a full vowel;
 - In the contemporary literature on synchronic analyses of tonal accent two different approaches can be distinguished: one employs lexical tone (Gussenhoven 2000; Gussenhoven & Peters 2004), the other is built on abstract foot structure (Köhnlein 2016, 2020). In Gussenhoven and Peters' work, Accent 2 is the marked accent, typically with a lexical tone (notationally marked as 'T') on either the first mora (e.g. in the Cologne dialect; Gussenhoven & Peters 2004) or the second one (e.g. in the Roermond dialect; Gussenhoven 2000). Representationally:
- (27) Accent 1: $\mu\mu$, such as /ʃtɛn/ 'stone (pl)'; here final /n/ is a coda;
 Accent 2: $\mu T\mu$ or $\mu\mu T$, such as /ʃtɛTɛn/ or /ʃtɛTn/ 'stone (sg)'; final /n/ is a coda following a lexical tone on one of the preceding moras.

In Köhnlein's work, Accent 2 is represented as a monosyllabic foot, and Accent 1 as a (phonetically monosyllabic) disyllabic foot.³¹ Accent 1 items end in an emptyheaded syllable lacking a vowel. In this approach, word-final consonants (such as word-final /n/) are thus syllabified as codas in Accent 2, and as onsets in Accent 1. Hence:³²

- (28) Accent 1: $(\mu\mu.\mu)$, such as /(/ʃtɛɛ.n)/ 'stone (pl)'; here final /n/ is an onset;
 Accent 2: $(\mu\mu)$, such as /(/ʃtɛn)/ 'stone (sg)'; final /n/ is a coda.

In Köhnlein's proposal, at an abstract level, in Accent 1 /n/ occupies a different position than in Accent 2; that is not the case in Gussenhoven's lexical tone approach. The foot structure approach seems more interesting for our findings

³¹ Historically, Accent 1 words were often disyllabic; see §5.1.3.

³² As to the notation: feet are marked with brackets, syllable boundaries with a dot.

(a) that in {VVn}-items with Accent 1, WFnD is blocked in all four varieties (§5.1.3) and (b) at least in the Ripuarian dialects in {Vn} words Accent 1 (whether realized or not) has a significant negative effect on the chances of WFnD to apply (case study 1 in §5.3).³³ Is that perhaps because, in the mora approach, at an abstract level the /n/ in Accent 1 words is not in the coda?

The realisation of an Accent requires primary stress, so here it is possible only in V(V)n words. For V(V)n words, we can draw up mora-equivalents of the representations in (12): for words where /n/ is realised (hence types I and the [n]-full subtype of III), the prosodic structure under the σ node is $\mu\mu\mu$ (Accent 1) or $\mu\mu$ (Accent 2). For types II and the [n]-less subtype of III, there are two scenario's: in the {Vn} words, no Accent can be realized, while in {VVn_a} and {VVn_b} words the Accents can be so – notably while [n] is lacking. This implies that in {Vn} words /n/ is a mora;

- *lexical (in cases where WFnD has been lexicalized)*
 - In the UoWorms and Eupen dialects, WFnD has been lexicalized in {-ən} as well as in some items with a long vowel (where /n/ is thus not needed as a mora bearing an Accent), especially of the {VVn_b} set;
- *prosodic*
 - The right-hand environment can be looked at from the point of view of prosodic domain boundaries. The relative 'depth' of the following prosodic boundary domain (Phonological Word, Phonological Phrase, Intonational Phrase, Utterance) seems to correlate with chances for WFnD to apply in Luxembourgish and the Trier dialect (Table 6).

Table 6. WFnD patterns for right-hand side (rows) and left-hand side (columns).³⁴

	Luxembourg / Trier				UoWorms / Eupen
	{-ən}	{Vn}	{VVnb}	{VVna}	{Vn}
compound	allophony			variable w/ one-sided allophony	variable
phonological word					variable, <i>but blocked if _## /d/...</i>
phonological phrase				blocked	
intonational phrase	variable w/ one-sided allophony				
utterance	blocked				

There are considerable dialectological differences among the four varieties, but in each of the two dialect groups shared patterns stand out. The insensitivity of WFnD in {-ən}, {VVn_b} and {VVn_a} rhymes in UoWorms and

³³ For the Moselle-Franconian dialects, we have not been able to analyze this statistically, but they exhibit the same tendency.

³⁴ The degree of shading indicates the different types of prosodic conditioning. In the UoWorms and Eupen dialects, sensitivity of WFnD to prosodic domain boundaries only applies in the {Vn} context.

Eupen to prosodic boundaries can be attributed to the fact that, in these environments, WFnd has evolved beyond the post-lexical level and is characterized by a high degree of lexicalization. In contrast, Luxembourg and Trier exhibit a more complex pattern, with multiple left-hand side contexts interacting in a specific manner with prosodic boundaries. Generally, the deeper the prosodic boundary, the less predictable WFnd becomes. For the most part, it is allophonic and hence (late) post-lexical. However, with increasing lexicalization and at deeper prosodic boundaries, WFnd loses its variability and is ultimately blocked at the level of the prosodic utterance.

- *interactions between segmental and prosodic factors*
 - The right-hand segmental environment has been found to interact most with the 'depth' of the prosodic boundary for the varieties of Luxembourg and Trier. In UoWorms and Eupen it only does so preceding phonological word boundaries;
 - Polysyllabic verb forms such as *teken* and *reken* (1 sg. pres. ind.) coincide with the verb stem and they probably end in a zero-suffix; in Ripuarian dialects, WFnd is blocked here and this is thus a case where morpho-syntax over-rides phonology. Apart from this, 'grammatical class' is probably an epiphenomenon of the interaction of prosodic and segmental conditions. In the RND data for 20 local dialects discussed in the first case study presented in §5.3, the factor group 'grammatical class' did not have a statistically significant effect on the chances of WFnd to apply.

7. An attempt at a holistic interpretation: the Life Cycle of Phonological Processes, diachrony and dialect-geography

Sound change tends to follow a fixed, unidirectional path from phonetics via grammar (phonology; morphology) to lexicon. This insight, known as the 'Life Cycle of Phonological Processes', is outlined in §4. Can this theory help us map the stepwise internal and geographical spread of WFnd in CF?

Crucial in this regard is the rule typology, which is based on the internal conditioning and distribution of the phenomenon in question. Once a phonetic process is no longer random and directionless (i.e. once it 'phonologizes'), it becomes systematic phonetic; however, the result is still gradient (phase 1). From the post-lexical phase onward, the result is no longer gradient. Prosodically, the process often becomes more narrowly constrained. Initially there is variation in the use of the new variant (phase 2), but this eventually gives way to categoricity in the sense of allophony, with both variants having their own, mutually exclusive internal distribution (phase 2'). Once the process interacts with morphology, phase 3, that of the lexical rule, has been reached. When the rule begins to lose its productivity, it becomes lexicalized (phase 4), that is, it freezes in the URs. The result is typically an unpredictable, lexically diffuse incidence (phase 5); in this phase the rule is dead.

A productive directional sound change (phase 1, 2 or 2') usually spreads geographically in wave-like patterns.

The further a rule has evolved in the cycle, the older it typically is. Is it possible to set up a diachrony based on the rule typology and the linguistic conditioning, such

that the emergence, development and spread of WFnD can be reconstructed diachronically in its internal and geographical unfolding? For the first step towards the answer to this question, we rely on the findings of the analyses in §§5.1 through 5.3. Based on the findings regarding distribution and conditioning, for each of the four dialects for each left-hand context, WFnD can be categorized into one of the phases mentioned, as is shown in Table 7.

Table 7. Rule-typological status of WFnD in the four types of left-hand context in the four CF varieties under study, considering the findings regarding the effects of the right-hand environment

	UoWorms	Eupen	Trier	Luxembourg	
1: systematic phonetic					
2: post-lexical, variation	{Vn}	{Vn}		{VVn _b }	↑ Diachronic Depth
2': post-lexical, allophony			{Vn} {ə̃n} {-ə̃n} {VVn _b }	{Vn} {ə̃n} {-ə̃n} {VVn _a }	
3: lexical rule				{VVn _b }	
4: lexicalization in progress					
5: lexicalized (dead rule)	{ə̃n} {-ə̃n} {VVn _a }	{ə̃n} {-ə̃n} {VVn _b }			
WFnD blocked generally		{VVn _a }	{VVn _a }		

As we argued and visualised in §5.1.5, rule typologically, WFnD apparently has only three ‘settings’ in these four dialects, two of which (2 and 2’, i.e. variation and allophony, respectively) differ subtly from each other.³⁵ Translating these settings into representations, we can distinguish three types:

- I /n/ is phonologically present (phase 5): WFnD is no longer productive, but diffusely lexicalized, so in some words the deletion is not lexicalized;
- II /n/ has completely disappeared from the UR, so that the morpheme or word at hand ends in a vowel. This is another possible outcome (phase 5), namely in morphemes and words in which WFnD is lexicalized;
- III /n/ is underlyingly present but floating, hence it is not linked to any higher prosodic structure. We have argued that this representation results from post-lexical WFnD.

³⁵ In the Riparian dialects there may well have been a historical period when WFnD functioned as a lexical rule (hence phase 3) targeting all relevant forms (except for the function words in (9)), but there is no evidence of this today. Nor is there any *direct* evidence of lexicalisation in progress (phase 4) in our UoWorms and Eupen data, although the findings presented in case study 1 in § 5.3 contain *indirect* indications of possible incipient lexicalisation of WFnD in {Vn} words in the 20 Riparian/Riparian-East Limburgish dialects studied.

In the latter type, /n/ may either surface if the constellation of stochastic factors gives rise to it (phase 2, variation, as in the Ripuarian/Ripuarian-East Limburg dialects; cf. the first case study in §5.3). Or it appears obligatorily as [n] on the phonetic surface as an allophone (phase 2'), i.e. when the right-hand segmental environment gives rise to it; it is not realized in all other right-hand environments; this is the situation in Moselle Franconian dialects. This shows how closely related post-lexical variation and allophony are.

Before we now try to reconstruct the relative chronology of the internal and geographical spread based on theory of the Life Cycle of Phonological Processes, we need to make sure that WFnd in these contexts can be considered as one single process. As can also be seen in Table 7, the patterns of post-schwa WFnd on the one hand and post-full vowel WFnd (in particular {VVn_a} and {Vn}) on the other seem to diverge. In addition, unlike final /n/ after a short vowel, final /ən/ cannot bear an Accent, since only syllables with word stress can bear an Accent. For these two reasons, we do not exclude the possibility that WFnd may have developed independently in both environments.

On the other hand, the fact that in the Ripuarian/Ripuarian-East Limburg dialects (with one exception) WFnd has been lexicalized both after schwa and after a long vowel and the fact that in the Moselle Franconian dialects WFnd is (with one exception) a post-lexical allophonic process both after schwa and after a full (long or short) vowel suggests that it is indeed a single process.

Following the theory of the Life Cycle of Phonological Processes and assuming a constant rate of spread both within and across varieties, WFnd may have started after schwa in {ən}, {-ən}, {VVn_a} and {VVn_b} contexts in UoWorms. With the exception of {VVn_a}, the equally Ripuarian/Ripuarian-East Limburg dialect of Eupen went the same way. Subsequently, WFnd developed into an allophonic post-lexical rule in the Moselle Franconian varieties in all left-hand contexts—with one exception: as in Eupen, WFnd in Trier never gained a foothold in {VVn_a}. WFnd seems to have taken off last after a short vowel in the two Ripuarian/Ripuarian-East Limburg dialects; there it is still only a variable post-lexical process. The findings from the first case study presented in §5.3 contain indications that WFnd may be on the way to lexicalization in the dialects of this group.

In this scenario, both after schwa and after a long vowel, WFnd seems to have had its cradle in the Ripuarian/Ripuarian-East Limburg dialects. In the dialects of UoWorms and Eupen, post-schwa and post-long vowel WFnd has become insensitive to prosodic domain boundaries and has been lexicalized – as for Eupen except for {VVn_a}. It is only after a short vowel that WFnd in these dialects is quantitatively sensitive to the right-hand segmental environment and to prosodic structure, hence post-lexical. And in Trier and Luxembourg, WFnd has the status of an allophonic post-lexical rule in all left-hand contexts.

As is evident from the findings presented in §§5.2 and 5.3, sensitivity to the relative 'depth' of the following prosodic boundary applies only to post-lexical WFnd. In UoWorms and Eupen, this concerns only {Vn} words, in Luxembourg and Trier also {-ən}, {ən} and {VVn_b} words.

As Table 6 (above) shows, if we restrict the comparison between the two dialect groups to the left-hand environment in which WFnd operates post-lexically, i.e. in {Vn}

words, we see that in UoWorms and Eupen, WFnd is blocked before a phonological word boundary if it is followed by a /d/-initial word. For all other prosodic boundaries, WFnd is variable across the board. In Luxembourg and Trier, before a coronal non-continuant (including /d/, /h/ or vowel, WFnd in {Vn} applies variably only at the boundary between two intonational phrases. For deeper prosodic boundaries than those between intonational phrases, WFnd in {Vn} in Luxembourg and Trier is blocked outright. So even if we restrict ourselves to the left-hand environment in which WFnd operates post-lexically in both dialect groups, only limited comparability in prosodic conditioning can be observed.

We cautiously conclude that WFnd has indeed always been a single process which has developed according to the theory of the Life Cycle of Phonological Processes, albeit with a phase difference presumably due to earlier phonologization in the Ripuarian/Ripuarian-East Limburg dialects. However, insofar as it is still at broadly the same stage of development in the two dialect groups, i.e. after a short vowel internal conditioning, although similar, seems relatively diffuse (as outlined in the previous paragraph).

8. Concluding and looking ahead

On the basis of its distribution and internal conditioning in some varieties of CF on the one hand and the theory of Life Cycle of Phonological Processes on the other, we have made an attempt to interpret, at least tentatively, the diachrony of and hence the multidimensional variation in WFnd in this vast area. The theory of the Life Cycle has thus served as heuristic instrument for the reconstruction of this diachronic development.

To make the picture less coarse-grained, the same data as in §§5.1 through 5.3 are needed for other varieties in the CF area. For the varieties discussed here (and especially for the Eupen dialect) more data are needed. But even then, the picture will be fragmentary, because we probably abstract from some of the variety-internal variation in the use of WFnd, not to mention patterns of dialect loss and convergence with surrounding varieties and the dominant standard language(s). On the other hand, what we aim at with this study is a reconstruction of the diachronic development, internal evolution and areal spread of WFnd, not its dismantling.

Our approach has yielded a deeper understanding of CF WFnd by taking into account the interactions of the left- and right-hand segmental environment with several types of prosodic boundary. WFnd is thus a further example of a complex, multi-causal phonological phenomenon, along with e.g. French *liaison* or Italian *raddoppiamento sintattico* (Passino 2013). Both phenomena originate in low-level phonetic effects at word boundaries—resyllabification and consonant sandhi in the case of *liaison*, and stress-conditioned gemination in the case of *raddoppiamento sintattico* (which has also been lexicalized – cf. e.g., *dappertutto* < *da per tutto* ‘everywhere’; *alla* < *a la*, *sulle* < *su le*). Over time, these processes have phonologized and later became subject to grammatical conditioning, lexical restriction, and partial lexicalization.

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