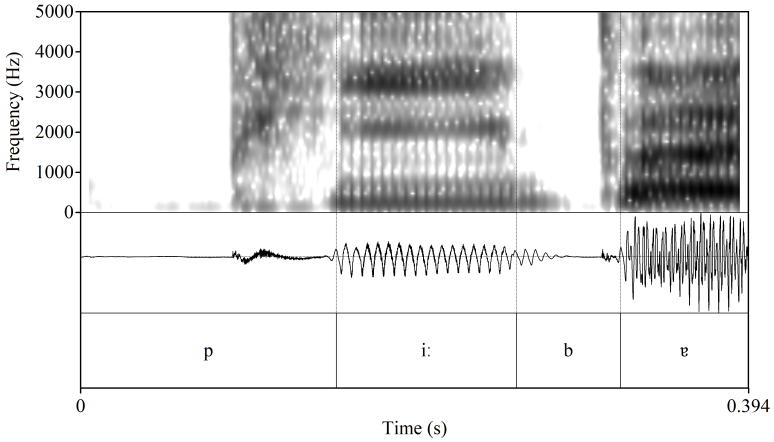
Metrical structure and Stratal Phonology provide a complete account of Danish stød

Yonatan Goldshtein & Pavel Iosad

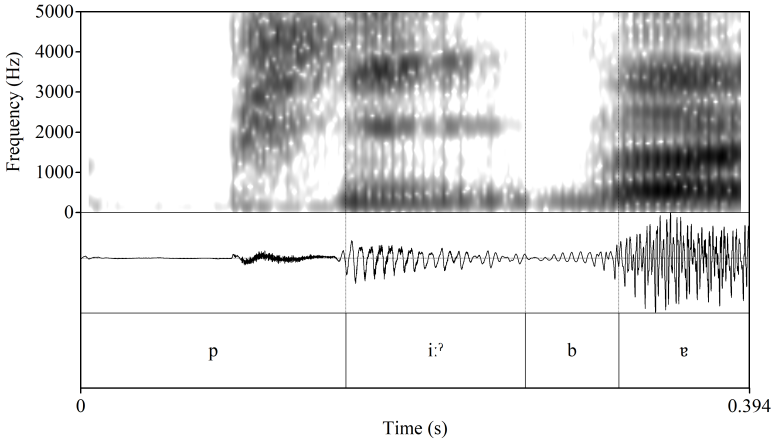
29mfm, 25th May 2022

What is stød?

The realization of stød



piber ‘pipe-PL’



piˀber ‘squeak-PRS’

Sound files credit: Andrea Brink Siem

Phonotactics

- ‘Stød basis’

Stød can only occur on a stressed syllable with a heavy sonorous rhyme

Syllable type	No stød	Stød
CV	*nu* 'now'	*
CV + obstruent	*kat* 'cat'	*
CVV	*tale* 'speech'	*rå?* 'raw'
CV + sonorant	*kul* 'coal'	*hal?* 'hall'
CVV + sonorant	*team* 'team'	*bi?l* 'car'

Distribution: anything goes?

Singular	Plural	Singular definite	Gloss
bi?l	*bi?ler*	*bi?len*	'car'
han	*han?ner*	*han?nen*	'male'
sum?	*summer*	*sum?men*	'sum'
ven	*venner*	*ven?nen*	'friend'

Key generalizations

Basbøll (2005) et passim

- The Non-Stød Model[1]

1. Stød is assigned to a stressed bimoraic syllable by default
2. Stød assignment can be blocked
   3. Phonologically: lexical extrametricality
   4. Morphologically: the Graded Productivity Model

[1] Hans Basbøll. 2003. Prosody, productivity and word structure: The stød pattern of Modern Danish. *Nordic Journal of Linguistics* 26. 5–44; Hans Basbøll. 2005. *The phonology of Danish*. Oxford: Oxford University Press; Hans Basbøll. 2008. Stød, diachrony and the non-stød model. *North-West European Language Evolution (NOWELE)* 54–55. 147–189; Nina Grønnum & Hans Basbøll. 2001. Consonant length, stød and morae in Standard Danish. *Phonetica* 58(4). 230–253.

Our key generalization

By default, stød is assigned to a stressed syllable at the word level, unless that syllable heads a disyllabic domain in the input to the word level

- Cf. Itô & Mester:[2] stød is blocked when a (ĹL) foot is coerced

[2] Junko Itô & Armin Mester. 2015. The perfect prosodic word in Danish. *Nordic Journal of Linguistics* 38(1). 5–36.

Domain structure and stød

- Stød is phonotactically impossible in syllables without a heavy sonorous rhyme
- Such syllables do act as heavy for stress assignment[3]
- See Iosad[4] for an initial proposal and Goldshtein (in preparation) for a comprehensive analysis
- Lexical extrametricality is a special case of this

[3] Itô & Mester, 'The perfect prosodic word in Danish'.

[4] Pavel Iosad. 2016. Prosodic structure and suprasegmental features: Short-vowel stød in Danish. *Journal of Comparative Germanic Linguistics* 19(3). 221–268.

- Main stress feet are preferentially monosyllabic (Ḿ), *except* that stems containing a single foot at the right edge show (ḾL) parsing

Our basic assumptions

- Stratal Phonology[5]
- Base-Driven Stratification[6]
  - $\sqrt{\text{root}}$ + $\mathcal{SL}$ affix = *stem-level* phonology
  - $[\sqrt{\text{root}}]_{\mathcal{SL}}$ + $\mathcal{WL}$ affix = *word-level* phonology
  - $\sqrt{\text{root}}$ + $\mathcal{WL}$ affix = *stem-level* phonology

Stød and stratification

- Stød is assigned at the word level
- Stød is blocked if a disyllabic domain was constructed at the stem level
- Therefore: inner-attachment affixation blocks stød

Analysis: monosyllabic nouns

Word-level suffix attachment

- No extrametricality: *bil* 'car'

	Singular	Plural
$\mathcal{SL}$	(*bil*)	(*bil*)
Stød?	yes	yes
$\mathcal{WL}$	*biˀl*	*biˀler*

- Lexical extrametricality: *han* 'male'

	Singular	Plural
$\mathcal{SL}$	(*ha*)<*n*>	(*ha*)<*n*>
Stød?	no: extrametricality	yes
$\mathcal{WL}$	*han*	*hanˀner*

Stem-level suffix attachment

- Plural *-e*, not productive: *hus* 'house'

	Singular	Plural
$\mathcal{SL}$	(*hus*)	(*huse*)
Stød?	yes	no: (σσ) input
$\mathcal{WL}$	*huˀs*	*huse*

[5] Paul Kiparsky. 2000. Opacity and cyclicity. *The Linguistic Review* 17(2–4). 351–367; Ricardo Bermúdez-Otero. 2012. The architecture of grammar and the division of labour in exponence. In Jochen Trommer (ed.), *The phonology and morphology of exponence: The state of the art* (Oxford Studies in Theoretical Linguistics 41), 8–83. Oxford: Oxford University Press; Ricardo Bermúdez-Otero. 2018. Stratal phonology. In S. J. Hannahs & Anna R. K. Bosch (eds.), *The Routledge handbook of phonological theory*, 100–134. London, New York: Routledge.

[6] Heinz J. Giegerich. 1999. *Lexical strata in English: Morphological causes, phonological effects* (Cambridge Studies in Linguistics 89). Cambridge: Cambridge University Press.

- Plural *-er*, unproductive behaviour for this suffix: *sum* 'sum'

	Singular	Plural
$\mathcal{SL}$	(*sum*)	(*summer*)
Stød?	yes	no: (σσ) input
$\mathcal{WL}$	*sumˀ*	*summer*

Stem-level suffix attachment continued

- Now with extrametricality: *ven* 'friend'

	Singular	Plural
$\mathcal{SL}$	(*ve*)<*n*>	(*venner*)
Stød?	no: extrametricality	no: (σσ) input
$\mathcal{WL}$	*ven*	*venner*

Monosyllabic nouns with epenthesis

- Extrametricality is irrelevant: stressed syllable coda is never word-final
- Epenthesis/syllabification is word-level
- Word-level attachment: *bibel* 'bible'

	Singular	Plural
$\mathcal{SL}$	(*bibl*)	(*bibl*)
Stød?	yes	yes
$\mathcal{WL}$	*biˀbel*	*biˀbler*

- Stem-level attachment: *finger* 'finger'

	Singular	Plural
$\mathcal{SL}$	(*fingr*)	(*fingre*)
Stød?	yes	no: (σσ) input
$\mathcal{WL}$	*fingˀer*	*fingre*

Exceptions

- Two groups of nouns lack stød on a non-final sonorant mora, where it cannot be due to extrametricality
  - Certain historical clusters: *mark* 'ground', *dirk* 'lock pick'
  - Borrowings: *team* (contrast *liˀm* 'glue')
- Also no stød in the plural

- These have to be stored as word-level exceptions, e.g. via *analytic listing*[7]

[7] Bermúdez-Otero, 'The architecture of grammar and the division of labour in exponence'.

Disyllabic nouns

Vowel-zero alternations

- Not all nouns ending in a consonant + sonorant behave like *bibel* or *finger*
- We analyse the following types as disyllabic with irregular syncope
- Syncope is stem-level, explaining why it has exceptions[8]
- Cf. Morrison[9] on a similar pattern in Scottish Gaelic

[8] Ellen M. Kaisse & April McMahon. 2011. Lexical Phonology and the lexical syndrome. In Marc van Oostendorp et al. (eds.), *The Blackwell companion to phonology*. Oxford: Blackwell Publishing.

[9] Donald Alasdair Morrison. 2019. Metrical structure in Scottish Gaelic: Tonal accent, glottalisation and overlength. *Phonology* 36(3). 391–432.

Word-level attachment

- No syncope: *helgen* 'saint'
- This is the regular pattern for disyllables

	Singular	Plural
$\mathcal{SL}$	(*helgen*)	(*helgen*)
Stød?	no: (σσ) input	no: (σσ) input
$\mathcal{WL}$	*helgen*	*helgener*

- Syncope will not apply prior to affixation, so there is no counterpart pattern with syncope

Stem-level attachment, syncope

- Unproductive *-e* plural: *himmel* 'sky'

	Singular	Plural
$\mathcal{SL}$	(*himmel*)	(*himle*)
Stød?	no: (σσ) input	no: (σσ) input
$\mathcal{WL}$	*himmel*	*himle*

- Unproductive stem-level *-er* plural: *vabel* 'blister'

	Singular	Plural
$\mathcal{SL}$	(*vabel*)	(*vabler*)
Stød?	no: (σσ) input	no: (σσ) input
$\mathcal{WL}$	*vabel*	*vabler*

Stem-level attachment, no syncope

- With *-er*, the predicted pattern is *vabel* ~ *vabeler*

  - Indistinguishable from the word-level attachment pattern
  - Often attested as a variant for this group of nouns
- With *-e*, the predicted pattern *himmel* ∼ *himmele* is unattested: gap?
  - The suffix *-e* is generally rare
  - Preference for *-e* to attach to surface monosyllabic bases

Lexical monosyllabic feet

- Underlying disyllables with lexical monosyllabic (stød-enabling) feet
- No syncope: *hummer* 'lobster'

	Singular	Plural
$\mathcal{SL}$	(*hum*)*mer*	(*hum*)*mer*
Stød?	yes	yes
$\mathcal{WL}$	*humˀmer*	*humˀmere*

- With syncope, the predicted pattern is *humˀmer* ∼ *humˀre*: indistinguishable from *biˀbel* ∼ *biˀbler*

Other morphology

- Unlike the plural, the definite clitic(s) (almost) always induce stød
  - Consistent outer attachment, as predicted morphosyntactically
- Derivation
  - Inner-attachment, unproductive suffixes: lexical stød (cf. *helgen* vs. *humˀmer*)
  - Outer-attachment, productive suffixes: maintenance of stød, opacity (*syˀ* 'sew' ∼ *syˀer* 'one who sews')
  - Semi-productive suffixes: dual attachment possibilities (*syˀning* 'sewing' but *rygning* 'smoking')

Compounds

Regular patterns

- Items with final stress regularly 'lose' stød when they are the first member in a compound[10]
  - Monosyllables lose stød when non-final in a compound
    - ⋆ *huˀs* 'house' ∼ *husbåˀd* 'houseboat' (N-N)
    - ⋆ *kriˀg* 'war' ∼ *krigsflyˀ* 'war plane' (N-*s*-N)
    - ⋆ *rødˀ* 'red' ∼ *rødkåˀl* 'red cabbage' (Adj-N)
    - ⋆ *finˀger* 'finger' ∼ *fingerringˀ* 'finger ring' (N-N with epenthesis)
  - Stem-final stressed vowels shorten[11]
    - ⋆ *industˈriˀ* 'industry' ∼ *industribyˀ* 'industrial town'
- Stød on a non-final syllable is preserved

[10] In our account, they fail to gain it

[11] And thus lose stød for phonotactic reasons

  - *raˀdio* 'radio' ∼ *raˀdiotårˀn* 'radio tower'
- Stød on a final syllable is preserved in longer roots
  - *passageˀr* 'passenger' ∼ *passageˀrtogˀ* 'passenger train'

Exceptional patterns

- In some compounds, exceptional stem-level constructs are stored nonanalytically, with maintained stød
  - *landˀ* 'land' ∼ *landmandˀ* 'peasant' (regular) ∼ *landˀsmandˀ* 'compatriot' (exception)
  - *rødˀ* 'red' ∼ *rødkåˀl* 'red cabbage' (regular) ∼ *rødˀgrødˀ* 'berry porridge' (exception)

Our generalization, now in compounds

> Stressed syllables in compounds have stød unless they are followed by another foot at the stem level

Stød loss: monosyllables

- *husbådˀ* 'houseboat': stød not assigned to *hus* as it is followed by another foot at the stem level

  $[(hus)_{\text{Ft}}(båd)_{\text{Ft}}]_{\mathcal{SL}}$

Stød 'preservation'

- Items with antepenultimate stress (*raˀdio*) regularly get stød because (ḾL) footing is disallowed
- Exceptional items (*rødˀgrødˀ*, *landˀsmandˀ*, *åˀbredˀ* 'river bank') have stems with nonanalytically stored stød in the first element
- Polysyllabic stems must project their own PWd: final monosyllabic foot gets stød

  $[(\text{passa}(\text{geˀr})_{\text{Ft}})_{\text{PWd}}((\text{toˀg})_{\text{Ft}})_{\text{PWd}}]_{\mathcal{SL}}$
- These patterns show limited productivity, as expected

Interim summary: nouns

- The essential generalization is that stød is assigned unless the syllable is non-final[12] in a stem-level domain
- The morphophonology of stød lines up with morphological patterns:
  - Outer attachment: productivity, phonological opacity
  - Inner attachment: lack of productivity, phonological transparency
  - No recourse to bespoke domain structure,[13] but some role for prosodic optimization[14]

[12] More specifically, heading a disyllabic foot at the right edge

[13] Basbøll, *The phonology of Danish*.

[14] Itô & Mester, 'The perfect prosodic word in Danish'.

Verbs

Verbs: summary of morphology

Form	'paint'	'talk'	'drive'	'see'
INF	*male*	*tale*	*drive*	*seˀ*
PRES	*maˀler*	*taˀler*	*driˀver*	*seˀr*
PAST	*malede*	*talte*	*drevˀ*	*såˀ*
PTCP	*malet*	*talˀt*	*drevet*	*seˀt*
IMP	*maˀl*	*taˀl*	*drivˀ*	*seˀ*

- Class I 'paint' (regular pattern)
  - Thematic vowel in PAST and PTCP ⇒ disyllabic stem, no stød
- Class II 'talk' (irregular pattern)
  - No thematic vowel, stem-level attachment of PAST and PTCP suffix
    - Disyllabic stem-level construct in PAST ⇒ no stød
    - Monosyllabic stem-level construct in PTCP ⇒ stød
- Strong verbs 'drive'
  - No syllabic suffix in PAST ⇒ stød
  - Disyllabic stem-level PTCP suffix ⇒ no stød
- Strong vowel-final stems 'see'
  - Stem-level INF suffix lost after a vowel ⇒ monosyllabic domain in stem-level output, stød

Unprefixed verbs: analysis

Form	Level	'paint'	'talk'	'drive'	'see'
INF	$\mathcal{SL}$	(*mal-e*)	(*tal-e*)	(*driv-e*)	(*se-e*) → (*se*)
	$\mathcal{WL}$	*male*	*tale*	*drive*	*seˀ*
PRES	$\mathcal{SL}$	(*mal*)	(*tal*)	(*driv*)	(*se*)
	$\mathcal{WL}$	*maˀler*	*taˀler*	*driˀver*	*seˀr*
PAST	$\mathcal{SL}$	(*mal-e*)	(*tal-te*)	(*drev*)	(*så*)
	$\mathcal{WL}$	*malede*	*talte*	*drevˀ*	*såˀ*
PTCP	$\mathcal{SL}$	(*mal-e*)	(*talt*)	(*drev-et*)	(*se-et*) → (*set*)
	$\mathcal{WL}$	*malet*	*talˀt*	*drevet*	*seˀt*
IMP	$\mathcal{SL}$	(*mal*)	(*tal*)	(*driv*)	(*se*)
	$\mathcal{WL}$	*maˀl*	*taˀl*	*drivˀ*	*seˀ*

Prefixed verbs

- Prefixed verbs have stød on the root even where the unprefixed one does not
  - *tal-e* 'speak-INF' ∼ *udtaˀl-e* 'pronounce-INF' ∼ *betaˀl-e* 'pay-INF'

- Contrast the behaviour of nouns under inner attachment
  - *hus-e* 'house-PL' ∼ *udhus-e* 'outhouse-PL'
  - *udtale* 'pronunciation'
- Both stem-level constructs!
- Bracketing paradox? No, prosody
  - $[[ud\text{-}tal^{\text{ʔ}}]_{\mathcal{SL}}\text{-}e]_{\mathcal{SL}}$: final in inner domain, regular cyclicity ⇒ stød
  - $[(ud)_{\text{PWd}}\text{-}((hus\text{-}e)_{\text{Ft}})_{\text{PWd}}]_{\mathcal{SL}}$: prosodic requirements of the prefix trigger construction of PWd and (ĹH) foot per the usual generalization ⇒ no stød

Summary and prospects

Overall conclusion

- The behaviour of stød emerges from relatively simple generalizations
  - Mono- vs. disyllabic domains
  - Familiar moraic phonology: stød basis, extrametricality
  - Stratal Phonology with Base-Driven Stratification
- Our analysis captures the phonological consequences of attachment asymmetries with no extra stipulations

Why domain size?

- Why would non-final stressed syllables reject stød?
- One possibility, following Köhnlein:[15] head vs. non-head morae
  - In a monosyllabic (Ĺ) foot, the stressed syllable is $\mu^{+}\mu^{-}$
  - In a disyllabic (ĹH) foot, the stressed syllable is $\mu^{+}\mu^{+}$
  - Laryngealization can only be assigned to non-head morae because of positional faithfulness[16]

Wider context

- Stratal Phonology accounts for morphology-phonology interactions in Danish stød
- 'Accentual' distinction between two types of syllables accounted for via domain (foot?) structure
  - Cf. 'metrical' approach to tonal accents in Germanic,[17] Scottish Gaelic,[18] Finnic[19]

Get in touch

- yonatan@cc.au.dk
- pavel.iosad@ed.ac.uk

[15] Björn Köhnlein. 2016. Contrastive foot structure in Franconian tone-accent dialects. *Phonology* 31(1). 87–123.

[16] Iosad, 'Prosodic structure and suprasegmental features'.

[17] Ben Hermans. 2009. The phonological structure of the Limburg tonal accents. In Kuniya Nasukawa & Phillip Backley (eds.), *Strength relations in phonology* (Studies in Generative Grammar 103), 317–372. Berlin: Mouton de Gruyter; Bruce Morén-Duolljá. 2013. The prosody of Swedish underived nouns: No lexical tones required. *Nordlyd* 40(1); Köhnlein, 'Contrastive foot structure in Franconian tone-accent dialects'.

[18] Morrison, 'Metrical structure in Scottish Gaelic'.

[19] David Odden. 1997. Some theoretical issues in Estonian prosody. In Ilse Lehiste & Jaan Ross (eds.), *Estonian prosody: Papers from a symposium*, 165–194. Tallinn: Institute of Estonian Language.

References

Basbøll, Hans. 2003. Prosody, productivity and word structure: The stød pattern of Modern Danish. *Nordic Journal of Linguistics* 26. 5–44.

Basbøll, Hans. 2005. *The phonology of Danish*. Oxford: Oxford University Press.

Basbøll, Hans. 2008. Stød, diachrony and the non-stød model. *North-West European Language Evolution (NOWELE)* 54–55. 147–189.

Bermúdez-Otero, Ricardo. 2012. The architecture of grammar and the division of labour in exponence. In Jochen Trommer (ed.), *The phonology and morphology of exponence: The state of the art* (Oxford Studies in Theoretical Linguistics 41), 8–83. Oxford: Oxford University Press.

Bermúdez-Otero, Ricardo. 2018. Stratal phonology. In S. J. Hannahs & Anna R. K. Bosch (eds.), *The Routledge handbook of phonological theory*, 100–134. London, New York: Routledge.

Giegerich, Heinz J. 1999. *Lexical strata in English: Morphological causes, phonological effects* (Cambridge Studies in Linguistics 89). Cambridge: Cambridge University Press.

Grønnum, Nina & Hans Basbøll. 2001. Consonant length, stød and morae in Standard Danish. *Phonetica* 58(4). 230–253.

Hermans, Ben. 2009. The phonological structure of the Limburg tonal accents. In Kuniya Nasukawa & Phillip Backley (eds.), *Strength relations in phonology* (Studies in Generative Grammar 103), 317–372. Berlin: Mouton de Gruyter.

Iosad, Pavel. 2016. Prosodic structure and suprasegmental features: Short-vowel stød in Danish. *Journal of Comparative Germanic Linguistics* 19(3). 221–268.

Itô, Junko & Armin Mester. 2015. The perfect prosodic word in Danish. *Nordic Journal of Linguistics* 38(1). 5–36.

Kaisse, Ellen M. & April McMahon. 2011. Lexical Phonology and the lexical syndrome. In Marc van Oostendorp, Colin J. Ewen, Elizabeth Hume & Keren Rice (eds.), *The Blackwell companion to phonology*. Oxford: Blackwell Publishing.

Kiparsky, Paul. 2000. Opacity and cyclicity. *The Linguistic Review* 17(2–4). 351–367.

Köhnlein, Björn. 2016. Contrastive foot structure in Franconian tone-accent dialects. *Phonology* 31(1). 87–123.

Morén-Duolljá, Bruce. 2013. The prosody of Swedish underived nouns: No lexical tones required. *Nordlyd* 40(1).

Morrison, Donald Alasdair. 2019. Metrical structure in Scottish Gaelic: Tonal accent, glottalisation and overlength. *Phonology* 36(3). 391–432.

Odden, David. 1997. Some theoretical issues in Estonian prosody. In Ilse Lehiste & Jaan Ross (eds.), *Estonian prosody: Papers from a symposium*, 165–194. Tallinn: Institute of Estonian Language.