



The Notion of Segment as a Challenge to a Sonority Syllable Model

CUNY PHONOLOGY FORUM, CONFERENCE ON THE SEGMENT

City University of New York, January 11-13, 2012

Hans Basbøll

Institute for Language and Communication,
University of Southern Denmark (at Odense)





Structure of the talk

1) Segment(ation) and Sonority

- 1) What about Danish (vs. Swedish)?
- 2) Sonority and the syllable: phonotactics

2) The Sonority Syllable Model (SSM)

- 1) The vocoid as the prototypical peak
- 2) Universal logic of segment types: Euler's circles
- 3) Introduction of time: a syllable model emerges
- 4) The circularity issue: Ohala's claims

3) The sonority syllable and the segment

- 1) margins of the syllable: [spread glottis]
- 2) segments of the same sonority (French)



1.1) Sound and sound structure of Danish

Combined effect of obstruent weakening and schwa-reduction (processes having started in the middle ages, cf. Swedish and Norwegian)



Gata
Koka

[gɑ:ta,
ku:ka]

Gade
Koge
[gæ(:)ð:,
kå(:)w:]





1.1) Sound and sound structure of Danish

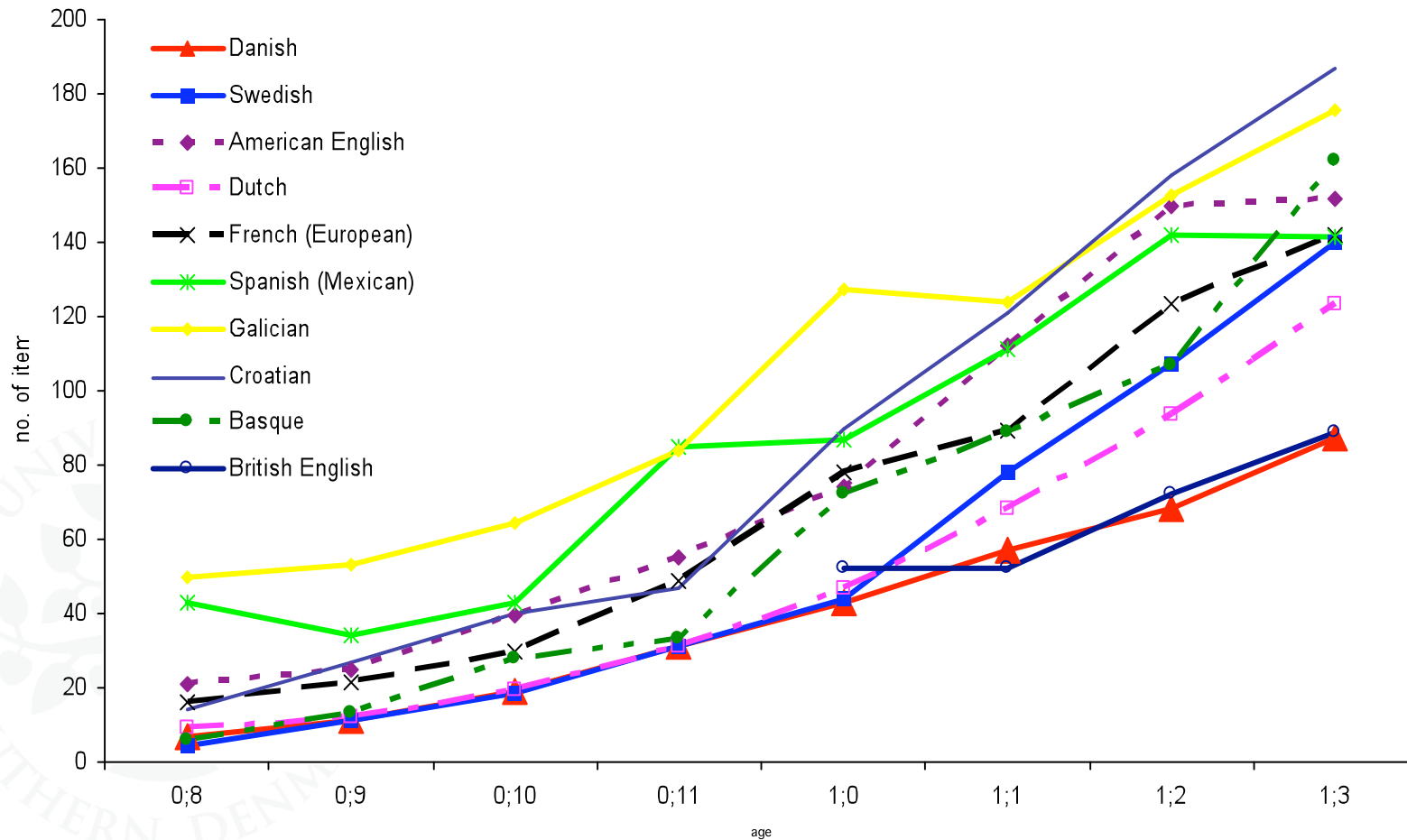
A hypothesis

- the vocalization of obstruents and the schwa-reductions may face the Danish children with a **HARDER TASK OF SEGMENTATION** which may affect their early comprehension abilities





1.1) Vocabulary comprehension score by age and study (median values) (see Bleses & al. in Journal of Child Language 35, 2008)





1.1) The linguistic perspective

- The vocalization of consonants and the frequent but not obligatory schwa-reductions resulting in long monotonous vocalic stretches make the Danish sound structure **INDISTINCT** ('unclear') and **WEAKEN CUES** for word and syllables boundaries or make them non-existent

- Swedish *gata, koka*: two syllables with **clear** boundaries (**/CV.CV/**), also clear boundaries between the segments!

- Danish *gade, koge*: *where is the syllable boundary? How easy is it to count syllables?* (**/CVC.əl/**)

HOW MANY SEGMENTS IN DANISH? **Badede** [bæ(:)ð::]



1.1) What to do with Danish?

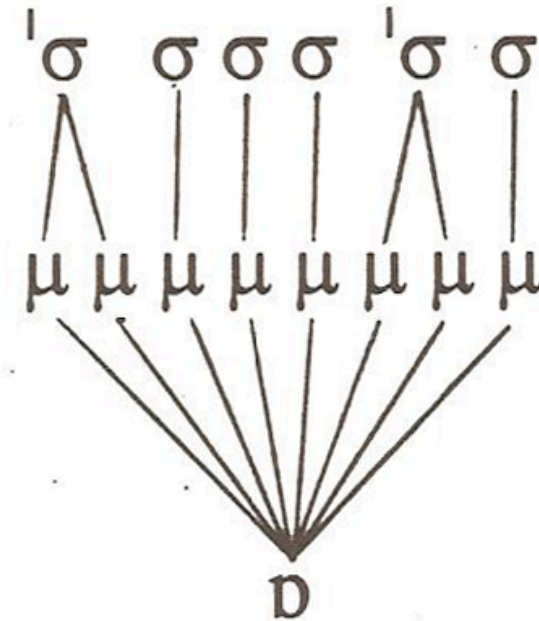
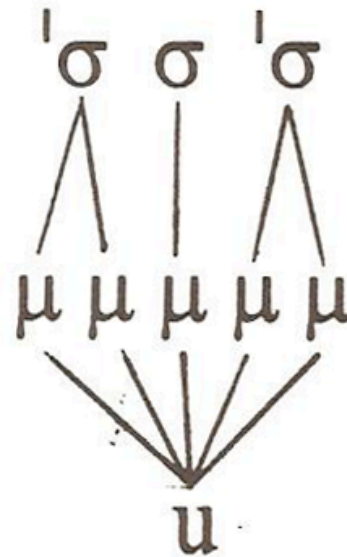
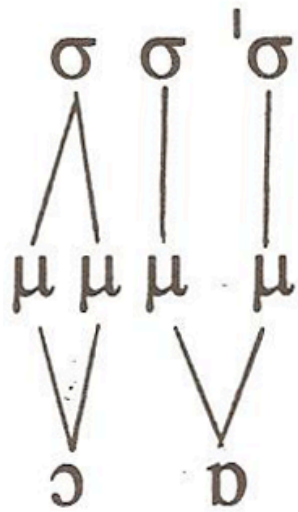
Danish syllable structure thus presents great challenges to any simple-minded notion of the segment: Rischel (2003) gives examples where what seems to be, *segmentally* speaking, one segment, is distributed over several syllables, e.g. the last example (*h*)årdere at åre(*lade*) 'harder to bleed' (said by a veterinarian before two elephants in a zoo).

Rischel called his paper

The Danish syllable as a National Heritage



1.1) *Koge o(ver), (L)uge u(denfor), (H)årdere at åre(lade)*; Rischel 2003





1.1) Sound structure in Danish and Swedish

Features causing indistinct sound structure

	Danish	Swedish
coda lenition	yes	no
light stressed syllables	yes	no
schwa elision	yes	no
/r/ elision	yes	no
semi-vowel elision	yes	no
length vacillation	yes	no
word accents	no	yes
final lengthening	no	yes
compulsory sentence accent	no	yes
signal for utterance function	weak and global	strong and local

Strong prosodic cues making sound structure more distinct

From Nina Grønnum (see www.cphling.dk, cf. Grønnum 2003, 2005)



1.1) Weak preterite forms in Scandinavia (Bleses, Basbøll & Vach 2011)

	Spoken forms	No of syllables in suffix (0,1,2)	No of vowels in suffix (0,1,2)	No of sonority rises from the stem-final C (0,1,2)	Word accent cue for suffix (non-stød/toneme 2) (0,1)
DANISH					
<i>-ede</i>	[lɔ:ɸ:ð:]	2	0	0	(1)
	[lɔ:ɸ:ð]	1	0	0	(1)
NORWEGIAN					
<i>-et</i>	[lɔ:vət]	1	1	1	1
<i>-a</i>	[lɔ:va]	1	1	1	1
SWEDISH					
<i>-ade</i>	[lɔ:vadə]	2	2	2	1
<i>-a</i>	[lɔ:va]	1	1	1	1
ICELANDIC					
<i>-aði</i>	[lɔ:vaði]	2	2	2	0
<i>-aðir</i>	[lɔ:vaðir]	2	2	2	0
<i>-uðum</i>	[lɔ:vYðYm]	2	2	2	0
<i>-uðuð</i>	[lɔ:vYðYð]	2	2	2	0
<i>-uðu³</i>	[lɔ:vYðY]	2	2	2	0



1.1) Suffix boundaries and sonority

(Bleses, Basbøll & Vach 2011, Basbøll forthcoming)

	<i>Suffix boundaries ("+")</i>		
	No of boundaries within <u>seg+seg</u> sequences	No of boundaries within vocalic sequences	% of boundaries within vocalic sequences
Danish <u>distinct</u>	33.381	9.623	28.8%
Danish <u>reduced</u>	20.087	6.406	31.9%
<u>Simulated Swedish/Norwegian</u>	33.381	2.687	8.0%

Table: Frequency of boundaries within vocalic sequences across suffix boundaries in Danish distinct, Danish reduced and in "simulated Swedish/Norwegian". (From Bleses, Basbøll & Vach, "Is Danish difficult to acquire? Evidence from Scandinavian past tense studies", 2011). Danish child language input (from our Odense Twin Corpus and Kim Plunkett's Childes-corpus), analysed in our OLAM-system. The part of our corpus analysed here contains 47,000+ utterances with 200,000+ coded words.



1.2) Sonority and phonotactics

- 1) Language-specific inductivism**
- 2) Cross-language inductivism**
- 3) Phonetic primitivism**
- 4) Innatism or Nativism**
- 5) General-phonetic deductivism**



Structure of the talk

1) Segment(ation) and Sonority

- 1) What about Danish (vs. Swedish)?
- 2) Sonority and the syllable: phonotactics

2) The Sonority Syllable Model (SSM)

- 1) The vocoid as the prototypical peak
- 2) Universal logic of segment types: Euler's circles
- 3) Introduction of time: a syllable model emerges
- 4) The circularity issue: Ohala's claims

3) The sonority syllable and the segment

- 1) margins of the syllable: [spread glottis]
- 2) segments of the same sonority (French)



2.1) The vocoid as prototypical peak

- 1) All languages have vocoids as peaks, only some have non-vocoids = contoids as peaks (*v/k*); all languages have contoids as non-peaks, only some have vocoids ("glides, semivowels"); thus **vocoids are prototypical peaks**; since the peak-function is central in the notion of the syllable, the point of departure here is the vocoid.
- 2) LADEFOGED (1971: 91) aptly says about his feature *Consonantal*:
"This feature has a different status from all other features in that it can be **defined** only in terms of the intersection of classes already defined by other features. Thus nonconsonantal sounds are nonlateral and sonorant [and also oral/HB]. They correspond largely to what PIKE (1943) called vocoids, which he defined as central resonant orals".
- 3) In my view, **cover features are preferable** to independently defined features, other things equal (Occam's razor!); this is particularly true for major class features.



2.1) The vocoid as prototypical peak

HB: [vocoid] =_{DEF} [sonorant, –stop, –lateral]

The features used here are all strictly binary. The marked (phonetically homogeneous) member of the opposition has no '+' (the '+' may be said to be implied): Vocoids constitute a phonetically homogeneous class, their opposite member (contoids according to Pike's terminology) do not, since they include plosives and fricatives as well as sonorant laterals, for example.

Sonorants are defined acoustically (following LADEFOGED (1971: 58): "a comparatively large amount of acoustic energy within a clearly defined formant structure", cf. p. 93: "greater acoustic energy in the formants"); they are – as their complementary class (obstruents), by the way – phonetically homogeneous.



2.2) Universal logic of segment types

- 1) The point of departure is the prototypical syllabic peak, which is a vocoid (a phonetic – as against "functional" – vowel; in the latter sense, it would be *circular!*).
- 2) All vocoids are, necessarily, sonorant: this follows from the definition.
- 3) But some sonorants are not vocoids, viz. prototypical (sonorant) laterals (which are [sonorant, lateral]) and nasal consonants (which are [sonorant, stop]).

ERGO: [vocoid] IMPLIES [sonorant] (and not the other way round!)



2.2) Universal logic of segment types

- 1) All sonorants are, *necessarily*, voiced:
- 2) this follows from the definition used here (LADEFOGED 1971: 58, 93) combined with the phonetic (articulatory and acoustic) fact that in order to get great acoustic energy in the formants (and this particularly concerns F1 due to the diminishing energy for higher formants), the vocal chords must vibrate.
- 3) On the other hand, there are non-sonorant sounds (called obstruents) that are voiced.

ERGO: [sonorant] IMPLIES [voiced] (and not the other way round!)



2.2) Universal logic of segment types

ERGO: [vocoid] *implies* [sonorant] *implies* [voiced].

Notice that e.g. [nasal] or [lateral] can never be part of such an implication chain (with [vocoid] as center)

This *universal logic of segment types*,

which is *independent of any aspect of time or order*,

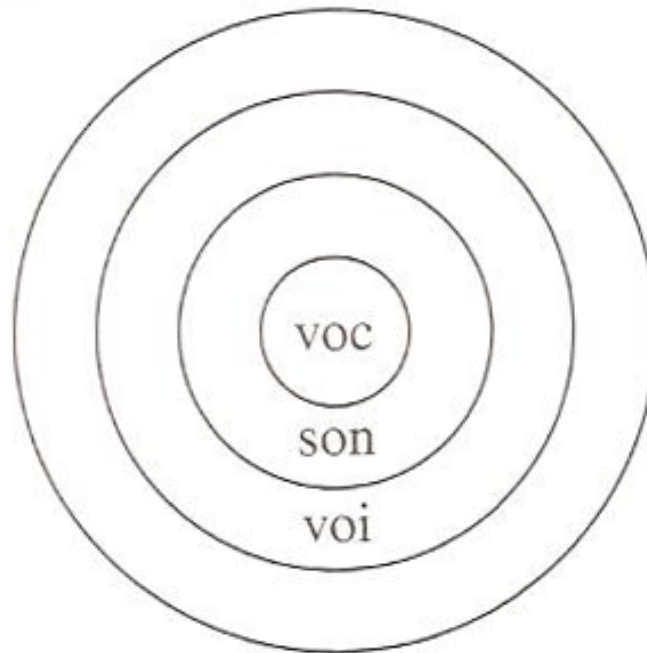
can be depicted by a set of (concentric) Euler's circles:



2.2) Universal logic of segment types

Universal logic of segment types (general phonetics)

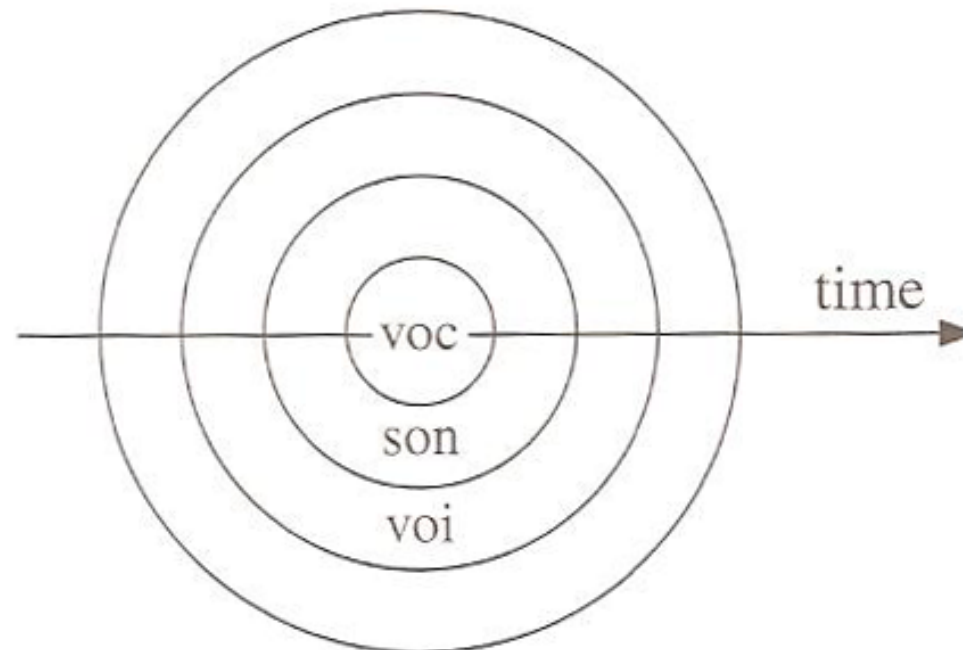
Vocoids as the starting point (peaks universally)





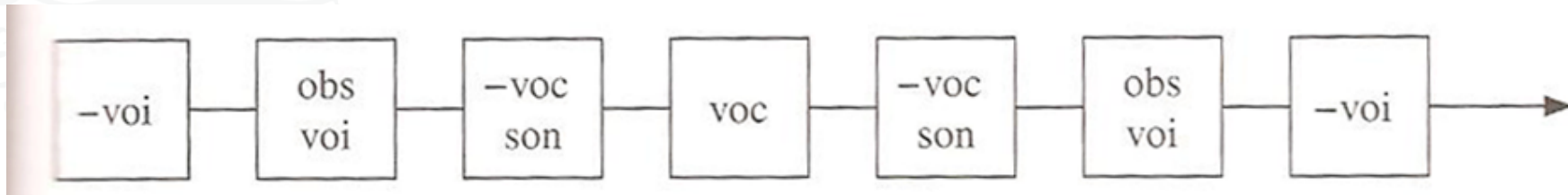
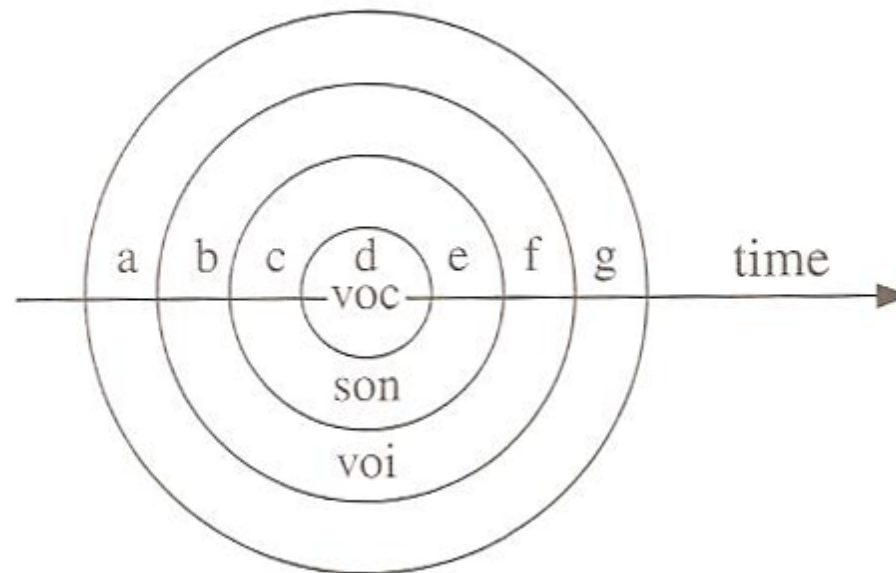
2.3) Introduction of time

Introduction of the time dimension turns the model into a Sonority Syllable Model (the logical force of the model)





2.3) Introduction of time: order classes





2.3) Universal logic: alternative

The only alternative set of Euler's circles with [vocoid] in the center (i.e. based upon the same logic of segment types) that I am aware of, is:

[vocoid] *implies* [sonorant] *implies* *[perceptually continuant]

(cf. the French term "continuante"; notice that it **cannot** be replaced by [stop] or [-continuant], these features cannot be part of the SSM, only very few features can which is a methodological advantage)

This version is *inconsistent* with the occurrence of [voiced] in the model (since it is neither true that perceptually continuant segments are necessarily voiced (cf. voiceless fricatives!), nor that voiced segments are necessarily perceptually continuant (cf. voiced plosives!))



2.3) Introduction of time: alternative

The alternative model, based upon the implication chain:

[vocoid] *implies* [sonorant] *implies* *[perceptually continuant]

would make the prediction that fricatives are *generally* higher on the sonority hierarchy than stops; many versions of sonority hierarchies follow this claim. But examples of the opposite order (like initial s + plosive in many languages, including Germanic) are well documented.

The main version of my model (with [voiced] but not *[perceptually continuant]) makes another prediction: that voiced plosives are not systematically more marginal than voiceless fricatives. In fact, initial sequences voiced stop + voiceless fricative, and final sequences voiceless fricative plus voiced stop, would be very difficult to master.



2.3) Major classes derived from [vocoid]

"Liquid" is an ill-defined term since the sound types it is supposed to cover, viz. laterals and "r-sounds", encompass many highly divergent sounds which do not behave uniformly w.r.t. sonority hierarchies (cf. Basbøll 2001)

Major classes *derived from the formal definition of [vocoid]*:

	V	L	N	F	P
[vocoid]	+	–	(–)	(–)	(–)
[sonorant]	(+)	+	+	–	–
[stop]	(–)	–	+	–	+



2.4) The circularity issue (cf. Ohala)

John Ohala has insisted (e.g. Ohala 1992, Ohala & Kawasaki-Fukumori 1997, Ohala 2008) that sonority or strength as explanations for syllable shapes are circular:

”...terms such as sonority, etc., are just labels for the rank ordering of segment types; they do not explain it”

(Ohala & Kawasaki-Fukumori 1997: 344).

[cf. Basbøll forthcoming]



2.4) The circularity issue (cf. Ohala)

- 1) If the universal logic of segment types can be upheld, the model is NOT circular; thus the definition of distinctive features used is crucial
- 2) The question is NOT whether some other definition is possible, or possibly better, BUT whether my definitions make phonetic and phonological sense in relation to existing vs excluded segment types
- 3) Aim: a framework for phonotactics (a *tertium comparationis*) which gives a **non-circular** basis for the analysis (BUT there are many phonotactic restrictions unrelated to sonority)
- 4) The "degree of coverage" empirically is different for different languages [and this applies to other proposals as well, incl. Ohala & Kawasaki-Fukomori's (which is also hard to falsify)]



Structure of the talk

1) Segment(ation) and Sonority

- 1) What about Danish (vs. Swedish)?
- 2) Sonority and the syllable: phonotactics

2) The Sonority Syllable Model (SSM)

- 1) The vocoid as the prototypical peak
- 2) Universal logic of segment types: Euler's circles
- 3) Introduction of time: a syllable model emerges
- 4) The circularity issue: Ohala's claims

3) The sonority syllable and the segment

- 1) margins of the syllable: [spread glottis]
- 2) segments of the same sonority (French)



3.1) Margins of the sonority syllable

- 1) Can there be a circle in the "the logic of segment types" outside [voiced], viz. [–spread glottis]?
- 2) This presupposes that all voiced segments are [–spread glottis].
- 3) This might be a phonetically problematic claim, due to the existence of voiced aspirated sounds: can they be considered NOT having a *widely* spread glottis? My answer is **yes**
- 4) This gives us a fine general syllable model (in time), with **[spread glottis]-sounds being marginal in the (mono)syllable (cf. the rest position, for breathing).**



3.2) Implementation Danish > French

The phonetic segments of French are **defined** in our Olam-system, so that French segments that do not occur in Danish (like the initial sound in *jeune*) are given a distinctive feature analysis so that our system can calculate with it.

Segments which are defined in the Olam-system (like [b d g]) but have another pronunciation in Danish (where they are voiceless) than in French (where they are voiced), are **redefined** so that all calculations (in distinctive features, prosodic patterns, and so on) can be made

pretending "French is like Danish"

(cf. Basbøll & Lambertsen in *PFC Paris* 2007, 2008, 2010, 2011; in 9e RRFP Tours 2011)



3.2) Implementation Danish > French

The phonetic segments of French (i.e. phonological in a concrete sense) are distributed into sonority classes defined by Basbøll's Sonority Syllable Model (SSM).

- [spr gl]**: *voiceless fricatives* (e.g. [s f]) **VIFr**
 - [not ptk as in Danish!]
- [-spr gl, -voi]**: *voiceless plosives* **VIPI**
- [voi, -son]**: *voiced obstruents* **VdOb**
- [son, -voc]**: *sonorant consonants* (phonetically) **SonC**
- [voc]**: *glides and vowels* (together!) **Voc[oids]**
 - (NB: they differ in syllabicity, not in sonority!)



3.2) Anti-sonority clusters: French

For initial CCC-clusters:

44 PhoSeq are registered in total, representing **13 SonSeq**

14 of these PhoSeq are illegal, representing **6 SonSeq**:

*11 of these PhoSeq have /r/ as their first member and (optional) deletion of schwa (e.g. [rklue]); this is morphologically conditioned (prefix r(e)-); they represent **4 SonSeq***

The 3 remaining illegal PhoSeq are [tsY- tsw- psS-], representing **2 SonSeq**.

Prediction: The marginal [t- p- (k-)] have spread glottis and thereby do not constitute violation of the SSM. *This can be tested phonetically (by observing the glottis).*



3.2) Anti-sonority clusters: French

For final clusters (2C, 3C and 4C):

37 SonSeq (+V) are registered in total (2 4C, 12 3C, 22 2C)

14 of these of these are illegal (4 are legal but not predicted).

The illegal SonSeq contain a sonorant preceded by { f s S } resp. { p t k }.

These clusters agree with sonority if the sonorant is devoiced (e.g. –fl).

Also **VdOb + SonC** occurs (e.g. –bl) [with no final schwa].

The illegal **VIFr + VIPI** SonSeq contain { f s S } followed by { p t k }.

Prediction: The marginal [-t -p -k] have spread glottis and thereby do not constitute violation of the SSM. *This can be tested phonetically* (by observing the glottis).



3.2) A-sonority clusters (French)

Glides:	IN & FI	do NOT combine
SonC:	IN	mn-, rl-, rm-, rn-
	FI	-mn, -rl, -rm, -rn, -rM (palatal)
VdOb:	IN	dZ-, gz-
	FI	-dZ, -gz, -dz, -bd
VIPI:	IN	kt-, pt-
	FI	-kt, -pt
VIFr:	IN	sf- ,
	FI	NO VIFr -clusters

tendencies: plosives first, /r/ first, dentals last

NO mirror-image of clusters with constant sonority!



Conclusion

- 1) The SSM is *unique*, I think, in its *non-circular and non-inductive* foundation – not building upon innateness postulates – residing in general phonetic and phonological categorizations, including the definition of [vocoid].
- 2) The approach with SSM can be applied to *all languages*. The application to French (using our Olam-system) has given interesting insights with relevance also outside French: (a) the *non-mirror-image character of a-sonority clusters* (as opposed to the mirror-image character of clusters categorized according to the SSM), and (b) the *predictions of glottis-position* for marginal segments.
- 3) The SSM is based upon phonological *segments* classified with respect to specific general phonetic dimensions (which can be represented as a set of Euler's circles with [vocoid] in the center). What defines the distinction between one and two identical segments, must be found in *prosody* and in *substitutability* (the *commutation test*, Hjelmslev).



Thank you!





References (i)

- Basbøll, H. (1973). Notes on Danish Consonant Combinations. *Annual Reports of the Institute of Phonetics, University of Copenhagen*. 7. 103-142.
- Basbøll, H. (1994). How to derive the sonority syllable from the prototypical peak. *Acta Linguistica Hafniensia*. 27. 51-65.
- Basbøll, H. (1999). Syllables in Danish. In H. v. D. Hulst & N. Ritter (eds.). *The Syllable: Views and Facts*. Berlin: Mouton de Gruyter. 69-92.
- Basbøll, H. (2001). What can be derived from just three binary features: Occam's razor and major classes for phonotactics. In N. Grønnum & J. Rischel (eds.). *To Honour Eli Fischer-Jørgensen = Travaux du Cercle linguistique de Copenhague XXXI*. 74-99.
- Basbøll, H. (2005). *The Phonology of Danish* (Series Phonology of the World's Languages). Oxford: Oxford University Press.
- Basbøll, H. (forthcoming). Monosyllables and prosody: the Sonority Syllable Model meets the word. In Stolz, T., Nau, N. & Stroh, C. (eds.). *Monosyllables*. Berlin: Akademie Verlag.
- Basbøll, H. & C. Lambertsen [presentations at PFC (= *Phonologie du français contemporain*), Paris, December 2007, 2008, 2010, 2011; and at 9e RRFPP (= *Rencontres du Réseau Français de Phonologie*), Tours, June 2011]



References (ii)

- Bleses, D., Basbøll, H. & Vach, W., (2011). Is Danish difficult to acquire? Evidence from Nordic past tense studies. *Language and Cognitive Processes* 26 (8). 1193-1231.
- Bleses, D., Vach, W., Slott, M, Wehberg, S., Thomsen, P., Madsen, T.O. & Basbøll, H. (2008). Early vocabulary development in Danish and other languages: a CDI-based comparison. *Journal of Child Language* 35. 619-650.
- Blevins, J. (1995). The Syllable in Phonological Theory. In J. A. Goldsmith (ed.). *Phonological Theory*. Oxford: Blackwell. 206-244.
- Grønnum, N. (2003). Why are the Danes so hard to understand?. In Galberg Jacobsen, H., Bleses, D., Madsen, T. O. & Thomsen, P. (eds.). *Take Danish for Instance – Linguistic Studies in Honour of Hans Basbøll*. Odense: University Press of Southern Denmark. 119-130.
- Grønnum, N. (2005). *Fonetik & Fonologi. Almen og dansk*. Copenhagen: Akademisk Forlag. 3d edn. [1st edn. 1998, 2d edn. 2001].
- Jespersen, O. (1897-99). *Fonetik*. Copenhagen: Det Schuboeske Forlag.
- Ladefoged, P. (1971). *Preliminaries to Linguistic Phonetics*. Chicago: University of Chicago Press.



References (iii)

- Laver, J. (1994). *Principles of Phonetics*. Cambridge: Cambridge University Press.
- Ohala, J. J. (1992). Alternatives to the Sonority Hierarchy for Explaining Segmental Sequential Constraints. *Papers from the Parasession on the Syllable*. Chicago: Chicago Linguistic Society. 319-338.
- Ohala, J. J. (2008). The Emergent Syllable. In Davis, B. L. & Zajdo (eds.). *The Syllable in Speech Production*. Francis & Taylor. 179-186.
- Ohala, J. J. & H. Kawasaki-Fukumori. 1997. Explaining Segmental Sequential Constraints. In S. Eliasson & E. H. Jahr (eds.). *Language and its Ecology: Essays in Memory of Einar Haugen*. Berlin: Mouton de Gruyter. 343-365.
- Pike, K. L. (1941). *Phonetics: A critical analysis of phonetic theory and a technic for the practical description of sounds*. Ann Arbor: University of Michigan Press.
- Rischel, J. (2003). "The Danish syllable as a national heritage". In Galberg Jacobsen, H., Bleses, D., Madsen, T. O. & Thomsen, P. (eds.). *Take Danish for Instance – Linguistic Studies in Honour of Hans Basbøll*. Odense: University Press of Southern Denmark. 273-282.

www.lexique.org