NOTES ON DANISH CONSONANT COMBINATIONS

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1. Introduction[1]

The "classic" paper on Danish consonant combinations is Vestergaard 1967, which is in turn based upon methods developed by Henning Spang-Hanssen (1959) and Bengt Sigurd (especially 1965). Of course, Danish consonant combinations have been treated in earlier works on Danish phonetics and phonology as well (e.g. Jespersen 1934 and Martinet 1937), but since this literature has been discussed by Vestergaard I shall only mention it in passing.

The present notes are of a highly tentative nature. Nevertheless, I think it worth while to present them for discussion despite the existence of Vestergaard's valuable paper, since there are some important respects in which Vestergaard's treatment is inadequate. As far as I can see it misses linguistically significant generalizations (there are also a number of minor disagreements between Vestergaard's presentation and mine, but I shall not burden the exposition unnecessarily by stating these):[2]

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1) I am very indebted to Jørgen Rischel for many improvements of my English style, as well as for stimulating suggestions on several of the topics of the present paper (cf. note 2).

2) Vestergaard's paper was discussed in about two of a series of seminars on "The syllable", conducted by Jørgen Rischel, in the autumn of 1969. A number of concrete criticisms of Vestergaard 1967 were brought up on that occasion, not least by Jørgen Rischel, but also by the participants (including Eli Fischer-Jørgensen (and myself)). Much of the criticism of Vestergaard 1967 which follows is inspired by these discussions.

(i) Vestergaard describes the combinations of Danish consonant phonemes, operating with a rather abstract phoneme inventory. It is one of the main claims of the present notes that several generalizations concerning Danish consonant combinations can only be captured by using an inventory of considerably less abstract consonantal segments (cf. section 2.). Note that it is not the question at issue whether Vestergaard's phoneme analysis is reasonable from one or another point of view, but rather it is an empirical issue on what "level" distributional restrictions are best described. I think that Vestergaard has made a bad choice in this respect, which obscures the regularities to be observed concerning maximal syllabic structure (section 5.).

(ii) Although he makes some interesting remarks on the distinction between accidental and systematic (or structural) non-occurrence, Vestergaard has not in all cases followed Spang-Hanssen's fundamental insight that the material must be considered open in order to allow a structural classification of its elements. To take a particularly revealing example, it can only be because the material is considered to be given once-and-for-all that an initial cluster /mj/ but not /nj/ is registered. The former only occurs in the interjection mjav and the loan word (from Old Icelandic) mjød, the latter in the famous Old Icelandic names Njal and (the god) Njord, which are in fact both pronounced with initial [nj] by the Danes. The two clusters seem to be quite analogous to Danes, and it would have been motivated either to exclude /mj/ by Spang-Hanssen's criterion of generalizability, or to include /nj/. (The latter solution is the more revealing of order restrictions, since /nj-/ is infinitely more possible than /jn-/ which is simply excluded.) The distinction in question leads Vestergaard to the conclusion that it is scarcely distributionally relevant to distinguish a class of "nasals", on which I disagree.

(iii) Vestergaard writes (p. 50 f): "The object of the present paper is the simple word, and all inflected forms are accordingly left out. This restriction is obviously necessary; a theoretically possible formation like aspskt (Asp+sk+t) being clearly in conflict with the phonotactic structure of the language - it would never be pronounced." This is a strange argument, since our task must be (among other things) to give rules accounting for which morpheme combinations are allowed within the same word and which are not; the example aspskt is an example of what is not allowed and not of what is "theoretically possible", and is therefore void of significance in Vestergaard's context. Furthermore, Vestergaard's inclusion of forms like tabt [tɑbd] (past participle of tabe [tæ:bə]) as monomorphemic because of the difference in vowel quantity between the participle and the infinitive (the vowel quality is uniquely dependent on the vowel quantity and the following consonant), is unwarranted. The vowel quantity is governed by rule (see Rischel 1970), and the relationship between the mentioned forms is quite transparent (see further sections 4.1. and 4.3. below).

(iv) Vestergaard has deliberately, as shown in the title of his paper, excluded medial clusters from examination. For the sake of completeness a brief survey of these is included here (section 6.). This is of course no criticism of Vestergaard's paper.

The preceding points of criticism should in no way be taken as indicating that Vestergaard's paper is not a good one. On the contrary, his exposition is both careful and extremely clear, and his treatment has a high degree of observational adequacy.

2. Inventory of consonants

The language described here is meant to be a neutral variety of Standard Danish, much like the language described in Rischel 1969, something in between what was called "Conservative Standard Danish" and "Advanced Standard Copenhagen" in Basbøll 1969.

In the language under consideration, what might be called the "diphthongization" of short vowel plus a following homosyllabic r or ʏ is carried through phonetically (similarly with that of short vowel plus v or j, but this is true in all varieties of Danish). Words like bær, steg, sagn are thus pronounced [bæɐ̯, sdaiˀ, sɑuˀn], the latter two rhyming with maj and havn respectively. (This diphthongization is general in contemporary Standard Danish, except in Jutland.) Note that the diphthongization in question has not in all cases led to a change in underlying forms, i.e. to restructuring; e.g. alternations like [gœɐ̯, gœ:rə] 'do(es)', 'to do' point to an underlying /r/ as the source of [ɐ̯], and compounds like sagfører ['sɑuˀˌfø:ɐ] 'lawyer' or savklinge ['sɑuˀˌkleŋə] 'saw blade' have phonetically identical first parts which (in the norm in question) in isolation are pronounced [sæ·ʔʏ] (sag 'case') and [sæ·ʔv] (sav 'saw'), respectively.

2.1. "Level" of description

As already mentioned, it is one of the main claims of the present paper that the distributional restrictions of consonants get their most general description when the consonantal segments in question are considered as considerably less abstract entities than in Vestergaard's paper. E.g. forms like

bær, steg, sagn above will be considered to contain diphthongs in the present distributional description, although the phonetic diphthongs are derived from underlying /VC/-combinations.

On the other hand, the consonantal segments will not be those in the phonetic surface structure either. The forms used here will be independent of certain late rules, notably of the rule which deletes [ɒ̯] after a low back vowel (whether this is a correct description of the rule is unessential here), e.g. ta'r [tɑ·ʔ] 'take(s)', present of ta' [tæ·ʔ] 'to take' will be considered as ending in a vowel plus [ɒ̯], i.e. as ending in a diphthong (cf. ser [se·ʔɒ̯]). Also the rule which devoices voiced non-vowels after an aspirated consonant seems to have no effect on the principles for consonantal distribution, i.e. the forms used here will have voiced l in plaske, phonetically [pl̥asgə], and sj- will be considered s plus voiced j, although in this combination j is generally unvoiced and (more or less) coalesced with s to [ʃ]. (These facts can of course be expressed by saying that the level of distributional description employed here "comes after" the "diphthongization rule", but "before" the "ɒ̯-deletion rule" and the "unvoicing-after-aspirates rule".)

Finally it should be pointed out that certain optional rules, which are to my knowledge of the "variable" sort discussed in Labov 1970 (the application of such rules seems to be correlated with socio-economic class membership of the speaker as well as with stylistic factors) seem also to have no influence on the distributional principles. This is true of the rule that turns [v] into [u̯] after long vowels and /r/, and the rule that shortens long vowels before voiced non-lateral continuants, especially in stød-syllables. The forms used here are thus [sgæɒ̯ʔv, læ·ʔv, u·ʔð, bo·ʔɒ̯] and not [sgæɒ̯ʔu̯, læ·ʔu̯ or læu̯ʔ, uðʔ, boɒ̯ʔ]. The relation between these

rules and the distributional description is different from that concerning the late rules mentioned above, since phonetic forms like those we use here are in fact found in the language under consideration, and therefore they do not constitute any proof that the description is not given on the phonetic surface. A form like [vɑp̰], on the other hand (the input to the "p̰-deletion rule") is non-existent phonetically and thus constitutes evidence that the description is not given on the phonetic surface (but it is of course possible that forms like [vɑp̰] should not be used in the distributional description).

2.2. Fragment of a distinctive feature matrix of Danish non-vowels

On the level discussed in the preceding section we have the following non-vowels (i.e. consonants and glides, see section 2.2.1. below): b d g p t k s f v ɣ ð m n ŋ l r u̯ p̰ i̯ h. Since h is limited to occur in one position, viz. as the only non-vowel in the initial part of the syllable, and thus never exhibits any order relation to any other consonant, h is not very interesting from our point of view once this fact has been stated. As a consequence, h will not be treated in the present notes, and it is therefore not included in the matrix below (its distinctive feature composition is controversial, but irrelevant for the present matter). In the matrix features referring to place of articulation are not taken into account:

	bdg	ptk	s	f	v	ɣ	ð	mnŋ	lr	u̯i̯
syllabic	-	-	-	-	-	-	-	-	-	+
sonorant	-	-	-	-	-	?	?	+	+	+
voiced	-	-	-	-	+	+	+	+	+	+
aspirated	-	+	+	+	-	-	-	-	-	-
sibilant	-	-	+	-	-	-	-	-	-	-
nasal	-	-	-	-	-	-	-	+	-	-
continuant	-	-	+	+	+	+	+	-	+	+

The meaning of the features "voiced", "sibilant", "nasal" and "continuant" is self-explanatory. The other features will be discussed below (the question marks are explained under the feature "sonorant", section 2.2.2.). Note that the feature matrix is intended to facilitate our discussion of distributional facts; it is not claimed that exactly the features above are those which are relevant for underlying forms or for instructions to the speech apparatus. (The relevance of the features in question will hopefully become clear in the following sections, not least section 5.)

It is clear from what was said above that the registered segments are not all in contrast. E.g.[u̯]in [hau̯]and [v] in [læ·ʔv] are underlying the same, namely /v/ (and in a taxonomic description they would be classified as members of the same phoneme /v/ since they are - in the language under consideration - in complementary distribution). But they are phonetically clearly distinct (although related), [v] being a labio-dental consonant, [u̯] a labio-velar glide, and this difference seems to be related to distributional factors (see sections 4. and 5.).

In cases where the syllable initial and syllable final realizations of an underlying segment are phonetically clearly distinct, they have not been classified as one segment (e.g. [t-] and [-d], [d-] and [-ð], [r-] and [-ɒ̯], see the following section).

2.2.1. The feature "syllabic"

A segment constituting the peak of a syllable is called a "vowel". Other segments (which may be called "non-vowels") are either syllabic (called "glides") or non-syllabic (called "consonants"). Two syllabic segments constitute a "diphthong", three a "triphthong", etc. Thus the feature syllabic expresses the common observation that if there is more than one phonetic vowel in a syllable, they are adjacent. This use of the feature "syllabic" has been proposed by Stephen R. Anderson (unpublished notes), and in fact it underlies Hjelmslev's (1951) use of the term "vowel" (although this use is not consistent with his own definitions, cf. e.g. Spang-Hanssen 1959, p. 38).[1]

According to the matrix above there are three glides in Danish: [u̯ ɒ̯ i̯]. These are all found postvocalically,[2] (e.g. in [hɒu̯], [bæɒ̯], [tʌi̯]).[3] [i̯] also occurs prevocalically (e.g. jeg [i̯ai̯]), whereas the prevocalic segments corresponding to (i.e. phonologically identical with) postvocalic [u̯, ɒ̯] are both phonetic consonants: [v, r].

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1) However, if one prefers to keep the traditional sense of the term "syllabic", some other feature should be used for designating the voiced phonetic vowels (whether they constitute the peak of a syllable or not).

2) The terms "pre-" and "post-vocalically" refer to the position in the syllable (the syllable division being in accordance with Basbøll 1972a).

3) Although the symbols for "extreme" (phonetic) vowels are used here, it is well known that the last segment when artificially isolated is considerably more central.

2.2.2. The feature "sonorant"

Although the Chomsky and Halle-definition of the feature "sonorant" (SPE p. 302) is not wholly satisfactory, there seems to be a high degree of consistency in the use of it (except for some sounds which do not concern us here, notably the h-sounds). The generalization is that vowels, glides, liquids, and nasals are sonorants, whereas fricatives, affricates, and plosives are non-sonorant (i.e. obstruents).

It seems reasonably clear that the labio-dental [v] is an obstruent (in distinction to [u̯] which is a sonorant), although it is generally frictionless. This is supported by the fact that [v] never has stød in contradistinction to [u̯] (cf. [læ·?v, hal?v] versus [grʌu̯?, sɑu̯?n]), and there seem to be good reasons for characterizing the class of segments that are able to receive the stød as "sonorant" (cf. Austin 1971 and Basbøll 1972b).

The case of [ð, ɣ] is less clear (hence the question marks in the matrix), and it is not even clear whether these have the same coefficient for the feature "sonorant". Phonetically they are frictionless, [ð] with a very loose constriction (much looser than that of English [ð]), [ɣ] probably with a little more constriction.[1] The criterion of ability to receive the stød points to the solution that [ð] should be sonorant (e.g. spid! [sbið?]) but [ɣ] non-sonorant (in a form like dag the last segment may receive the stød, but only

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1) Note that [ɣ] only appears after liquids: [l, ʁ] and after long vowels (e.g. elg, dværg, dag [ɛl?ɣ, dvæʁ?ɣ, dæ·?ɣ]). After short vowels [ɣ] has vocalized to [i̯] (after front vowels) or [u̯] (after back vowels), see section 2. above.

if it has vocalized). This may not be phonetically nonsensical, and it is assumed here since this makes the distributional facts easier to understand (sections 4. and 5.).

2.2.3. The feature "aspirated"

It is well known that the phonetic distinction between [bdg] and [ptk] is mainly one of aspiration (and in the case of [d] and [t] also of affrication), both series being voiceless. In the matrix we have classified [ptkfs] together as a class of "aspirated" sounds (it is uncertain whether [h] should be included in this class too). There are the following reasons for this analysis (it should be noted that [ptk] occur prevocalically; postvocalically they are only found after a short vowel plus r):

(i) After exactly these five consonants a voiced non-vowel in the same syllable is devoiced, or, stated in another way: some of the aspiration phase occurs contemporarily with the (underlyingly) voiced non-vowel. (However, this effect may be greater after the aspirated plosives than after the fricatives.)

(ii) A postvocalic r followed by one of these five consonants does not constitute a stød-basis in Conservative Standard Danish (cf. Basbøll 1970 p. 19 ff).

(iii) The important glottographic study of some Danish consonants by Frøkjær-Jensen, Ludvigsen and Rischel (1971) shows that the laryngeal gesture of aspirated plosives and voiceless fricatives is suggestive of a common articulatory command for these sounds, as opposed to the much weaker gesture of the unaspirated plosives. (It is probably a consequence of this

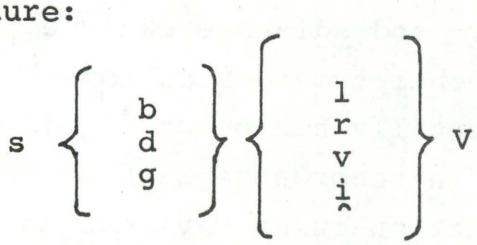
command that [fs] are often aspirated (Jørgen Rischel, personal communication).)

Of course, not all of the arguments given above indicate that "aspiration" is the relevant feature, but we consider the class ptkfs to be well-founded, and this is the important issue for our purpose.

3. Initial clusters

3.1. Three member clusters

All initial three member clusters in Danish are of the following structure:



Note that the columns are both "natural classes" in a phonological sense, since [bdg] are the only unaspirated plosives[1] and [lrvj̊] the only voiced non-nasal non-vowels (or, equivalently, the only voiced continuant non-vowels). (Furthermore, [s] is the only sibilant.)

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1) Vestergaard (1967 p. 48 f) considers s plus plosive to be phonemically /sp, st, sk/ (there is only one series of plosives after s). He claims that phonetically there is doubt as to the identification of the plosive with either bdg or ptk, and then chooses the latter possibility (in accordance with Uldall 1936), because of what he calls "Hjelmslev's law", i.e. the principle that the existence of a cluster xyz presupposes the existence of xy and yz, but not inversely (cf. Fischer-Jørgensen 1952 p. 35). This principle demands the interpretation /skv/ in skvat, etc. since /kv/ can be found (kvist, etc.), but not /gv/. I find this argument objectionable. There is absolutely no doubt as to the phonetic identification of the plosive after s since the only stable distinction between the two series of plosives is one of aspiration (cf. section 2.2.3.), and aspiration is absent after s. Furthermore, the non-occurrence of /gv/ is certainly an accidental gap and should thus not be used as a structural argument. And a further argument against Vestergaard's position is the fact (noted by himself p. 48) that /sv/ exists, but not /sf/, and this distinction is certainly systematic. (Fischer-Jørgensen points out that /gv/ occurs medially in the foreign word lingvist.)

The formula predicts the following initial three-member clusters in addition to the ones registered in Vestergaard's material (which for practical reasons is reproduced in toto as an appendix (section 8.) to the present paper): sbv, sdl, sdv, sgl.

The question arises whether these clusters are accidental or systematic gaps (cf. Vestergaard 1967 p. 49 f and Fischer-Jørgensen 1952, chapter VI). I think the most important fact for deciding on this matter is the observation that neither bv- nor pv- exist in isolation, and similarly neither dl- nor tl-, whereas both dv- and tv-, and both gl- and kl- occur. I.e., we can formulate the rule that /v/ never occurs after labial plosives, and /l/ never after dental plosives, and hence sbv- and sdl- are excluded, whereas no such rules prohibit the other two combinations, and hence sdv- and sgl- are only accidentally non-occurring (cf. the foreign word sklerose). This is in accordance with my intuitions. The two mentioned non-combination rules may lead to the hypothesis that homorganic non-vowels do not combine initially. This hypothesis will be examined in section 3.2.2. below.

3.2. Two member clusters

3.2.1. Order restrictions

When one tries to set up "order classes", two points of view can be in conflict with each other:

(i) If the material is considered closed, or phonotactically homogeneous, one tries to establish as few order classes as necessary to account for the observed order relations, the philosophy being that the fewer the order classes,

the less over-generating the model, other things equal. (This can be done in a rather mechanical manner, although in some cases there will be doubt as to where to place a given consonant.) This is the line taken by Vestergaard.

(ii) If the material is considered open and heterogeneous from a phonotactic point of view, one may be interested in characterizing as many ordering relations as possible, viz. to establish as many order classes as possible. To take an example, Vestergaard's material (from Dansk Retskrivningsordbog) does not give any reason for separating the phonemes /lrjn/ into several order classes. Since the group /nj/ seems to be just as well established as /mj/ (as mentioned in section 1.), /n/ should belong to a more vowel-remote class than /j/. But even apart from the nasal, the phonemes /lrj/ could be split up since /lj/ is certainly more possible than /jl-/ which is clearly excluded. Thus, if one is interested in characterizing as many order relations as possible, preliminary order classes should be split up until it is true for any two members of one order class that both configurations of them are equally impossible (this presupposes that there is at most one acceptable order of any two consonants, which is true for the initial position). That is, although none of the initial combinations of v, l, and j belong to Vestergaard's material, one could nevertheless set up three order classes for those three consonants as follows: v l j since the following groups are in fact found, outside Vestergaard's material (they are indeed quite possible for Danes in distinction to the "reverse" clusters): /vl-/ (Vladimir), /lj-/ (Ljubljana), and /vj-/ (Vietnam).

It will be clear from the above considerations and the introduction that in principle we consider the latter proce-

dure the more linguistically interesting. It will lead to the following order classes initially:

V	IV	III	??	II	I	
s	bdg fptk	v	mn	lr	i̯	VOWEL

Note that the order classes are rather homogeneous from a phonetic point of view. For a phonetic characterization of the order classes, see section 5.

This scheme shows that we have (at most) five order classes initially. The question marks above the nasals signify that on the present basis it is not possible to make a non-arbitrary decision on whether /mn/ belong to II or III (to my intuition, at least, groups like /vn-/ and /ml-/, etc., seem equally impossible), but that they do not constitute a separate order class.

In a more restricted material which does not include groups of a liquid plus [i̯], it is sufficient to operate with four order classes (as does Vestergaard, but he splits up the nasals), and then there is no doubt that the nasals should go together with v:

IV	III	II	I	
s	bdg fptk	v mn	lr i̯	VOWEL

This order scheme generates all Danish initial two- and three-member clusters. Initially there are at most three non-vowels in a row, and when there are three, these are subjected to strong restrictions (section 3.1.). The model is, however, over-generating for two member clusters as well and should thus be supplied with restrictions of other sorts, as will be discussed next.

3.2.2. Other restrictions

(i) In section 3.1. we advanced the hypothesis that homorganic non-vowels do not combine initially. This hypothesis is confirmed for two member clusters as well, with the following restatement of Vestergaard's phonemic classification: The velar stops are neither homorganic with (the uvular) r, nor with (the palatal) j,[1] whereas Vestergaard operates with a class of "palatals" including k g j ɣ ŋ r (p. 55). And since s does combine with dentals (sd, sl, sn), s does not "count as" homorganic with any other non-vowel.[2] Furthermore it should be noted that labiodentals (f v) belong to the labial class (in agreement with Vestergaard), which agrees well with the fact that the influence of a following homosyllabic labiodental on a preceding short a is like that of a bilabial but different from that of a dental (cf. Basbøll 1972a). By this principle (i) the following non-occurring initial two member clusters, which are in accordance with the order restrictions, are excluded: bv,[3] pv, fv, bm, pm, fm, dn, tn, dl, tl, nl.

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1) In our framework this latter fact could of course be interpreted as indicating that the restriction concerns only consonants, not glides.

2) Since r is the only non-vowel which does not combine with s initially (except for h, of course, which as mentioned is completely non-combinable and therefore ignored in the present notes), one might treat initial s and r as constituting a functional "homorganity class" ("queer dentals", cf. the fact that r distributionally acts like dentals (including s) in several respects, see the end of section 6.).

3) The group bv is found in the interjection bvadr, used in the Danish translation of Charles M. Schultz' (comic strip) "Peanuts" (in Danish: "Radiserne"). Note that its final consonant group is aberrant too.

(ii) s does not combine with aspirated consonants or, more generally perhaps, aspirates do not combine initially. This restriction excludes the following non-occurring initial two member clusters which are in accordance with the order restrictions: sf, sp, st, sk.

(iii) m does not combine with plosives initially. This restriction excludes bm, pm, dm, tm, gm, km (bm, pm were already excluded by virtue of principle (i)).

(iv) Nasals and liquids do not combine initially. This restriction excludes ml, mr, nl, nr (of which nl was already excluded by principle (i)). However, if the nasals and liquids belong to the same order class, (iv) should be replaced by the restriction that voiced obstruents and nasals do not combine initially (the same is true finally, cf. 4.2.2.1. and 5.).

Now, there are only two non-existent initial two member clusters satisfying the order restrictions which are not excluded by principles (i)-(iv), namely bn- and sr-, both of which seem impossible to me.[1] Concerning bn it should be noted that pn- is found (thus pronounced) in foreign (Greek) words like pneumatisk (cf. Vestergaard p. 50), so maybe bn- is not a structural impossibility. For the non-existence of sr-, cf. note 2 of the preceding page.

4. Final clusters

4.1. Mono- or polymorphemic?

It was mentioned in the introduction that Vestergaard requires that both parts of a suggested bimorphemic word be found independently in other words in exactly the same phonemic

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1) /nj/, /vj/, and /vl/ are here considered to be possible clusters. /kj/, which according to Vestergaard (p. 40) is not found in any monosyllable, occurs in my language in kiosk [kj̊ʌsg] (like [kj̊o:lə] which Vestergaard mentions).

shape, and furthermore that the suggested stem occurs as an isolated word, in order to recognize a morpheme boundary between them. I agree that the distinction between mono- and polymorphemic clusters is important, but I recognize more morpheme boundaries than Vestergaard, i.e., some of his monomorphemic clusters will be broken up here (section 4.2.1.).

To fully understand the implication of this disagreement with Vestergaard, the following remark should be made. As for the distinction between accidental and systematic gaps, I do not think the subclass of final clusters appearing in native monomorphemic words is a particularly interesting one, since I would like to suggest the hypothesis that final clusters appearing in polymorphemic words can be freely introduced in monomorphemic words too.[1] (Something resembling this idea can, of course, be found many places in the literature, see e.g. Vestergaard p. 57 with reference.) This principle has the further consequence that a statement about the clusters occurring finally in native monomorphemic words is less of a hypothesis and more of a simple registration than was the case in section 3. above. In my view, this also justifies a higher degree of exclusion of registered material by the criterion of generalizability (cf. Spang-Hanssen 1959 p. 110 ff) than before. On the other hand, this conclusion forces us to try to state the principles determining the occurrence of sequences of morphemes that do not contain any vowel (which Vestergaard has not aimed at doing), e.g. to state which constraints are violated by a sequence like aspskt. This will be attempted in section 4.3.

One further remark: I fully agree with Vestergaard that imperatives should be left out of the primary material. On

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1) Thus new monomorphemic words can be introduced without any cluster simplification even if they end in a "polymorphemic" cluster (the reservation should be added that the number of consonants may not exceed that found in monomorphemic words).

the other hand, Spang-Hanssen (p. 218 ff) includes even the oddest imperatives, like mejsl! or hindr!. Spang-Hanssen is not much concerned with order phenomena, and so this procedure is of minor consequence, whereas it would seriously affect our treatment. It should be pointed out that disregarding the imperatives at the outset (which does not prevent that they may eventually be classified according to the criteria established for the rest of the material, cf. Basbøll 1970 p. 21-23) is not free of commitment: An infinitive which ends in shwa preceded by a cluster, and which is not excluded from the material as "foreign" or the like, should either have a medial cluster which is acceptable as a final cluster too, or a medial cluster which can be resolved into a final cluster (that is acceptable) plus one of the consonants /l r n/ (see section 6.). E.g., if the verb sløjfe is not excluded from the material, jf must be recognized as a possible final cluster (in monosyllables it is only found in imperatives and the name Leif, cf. Vestergaard p. 51), since f cannot occur in a shwa-syllable according to section 6. (If the conditions on shwa-syllables should turn out to be different than claimed here, this might of course invalidate the argument). Note that the special status of the imperatives is not expressed simply by classifying them as bimorphemic (the second morpheme being a sort of "subtraction morpheme", cf. Uldall 1936), since their phonotactic structure is often contradictory to the phonotactics not only of monomorphemic but also of polymorphemic words.

4.2. Monomorphemic clusters

4.2.1. Three member clusters

In Vestergaard's material (p. 57, reproduced in section 8.) there are only three clusters which do not begin with a sonorant, viz. (in his notation) /psk/ glubsk, /kst/ takst, /tsk/ skotsk. However, the examples given are clearly bimorphemic, cf. glubende (appetit), taksere, Skotland. They

have been included as monomorphemic by Vestergaard's criterion that in order to be bimorphemic the stem of a word must be found as an isolated word (no word glub exists, and taks, skot are only found as clear homonyms to the stems in question). Furthermore, glubsk has, quite regularly, a short vowel in distinction to glubende, and as already mentioned this will suffice for Vestergaard as a criterion for not recognizing them as instances of the same stem. According to Spang-Hanssen's table 5 (1959, at the end of the book), the only occurrences of such monomorphemic final clusters are 3 examples of kst (which are not listed). These probably include vækst (which according to our criteria is bimorphemic, cf. vokse) and tekst (a foreign word, whose t does not belong etymologically to the root, cf. Latin textum, texere). In my view, this indicates that the clusters in question do not belong to the core of native monomorphemic final clusters.

When we consider the rest of Vestergaard's material, the following clusters are in some way deviant from the core of final monomorphemic three member clusters (cf. Spang-Hanssen 1959 p. 167, from where the following data is taken): /rts/, found only in five (foreign) words, viz. erts, marts, sirts (rare), terts, kvarts, /rft/, found only in one (foreign) word, viz. værft, /lkt/, found only in one (archaic) word, viz. mulkt, often pronounced without /k/, /lft/, found only in two (archaic) words, viz. hælvt, tylvt, of which the latter is often pronounced without /f/ and the former with either /v/ or /f/ (cf. its near homonym helt [hɛl?d]). The only cluster of any importance among these is /rts/. The reason why the foreign words ending in /rts/ seem to have been so readily accepted phonotactically (i.e. without simplification of their final cluster) is probably that the cluster is very common in morphemically complex forms, viz. genitive forms in rt+s, cf. section 4.1. above.

The remaining clusters of three consonants all consist of a sonorant plus s plus a non-labial plosive. Furthermore, every form containing a cluster of this kind which ends in a velar (viz. /rsk, lsk, msk, nsk/) is an adjective. Among Vestergaard's examples dansk is clearly bimorphemic according to our criteria (cf. Danmark, danificere, etc.), and the other three: harsk, falsk, lumsk might be called "pseudo-derived" even though there is no synchronically probable root for them to be derived from. This is not meant as an exact description, let alone an explanation, but only as a suggestion that the examples with -sk are peculiar in some way.

One need not be bothered by the fact that there seems to be no fixed borderline between clusters which we accept as monomorphemic, and clusters which must be polymorphemic[1] . On the contrary, it is a consequence of the assumption made in section 4.1. that no such clear-cut borderline should be expected.

Note that the non-vowels which occur in the first position of a native monomorphemic final three member cluster form a "natural phonological class", comprising the sonorant non-vowels. There is one exception: [ð] is not found in this position. However, this need not lead to a revision of our classification of [ð] as a sonorant (see sections 2.2.2. and 4.2.2.1.), nor does it force us to give up the idea that phonotactic facts should be expressed by means of "natural classes" in the phonological sense. Instead, the non-occurrence of [ð] can be illustrated by referring to the rule which deletes [ð] before a dental stop belonging to the same word (cf. Rischel 1970). John Austin (1971 p. 46 ff) has proposed to enlarge the scope of the rule to apply before all dental obstruents, i.e. also before s, in order to account for pronunciations like bidsel [bisəl], historically derived from

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1) although one may, of couse, (like Vestergaard) choose one fixed criterion to decide all cases.

bide [bi:ðə]. Similar examples are fødsel, ødsel [føsəl, øsəl] 'birth', 'extravagant', derived from føde, øde [fø:ðə, ø:ðə] 'give birth to', 'waste (money etc.)' with the non-productive and rare nominalizing suffix sel (the same as in bidsel).[1] One could adduce examples like bedst [bɛsd], cf. bedre [bɛðrə], and alternative pronunciations in rare forms like nådsensbrød ['nʌsəns,brø̰ʔð] and bådsmand ['bʌs,manʔ].

However, the deletion of ð before s only occurs in some fixed forms (like bedst) and in some forms in which the morpheme boundary is not very transparent (like bidsel), but never before e.g. the genitive ending s. The connexion between the transparency of the morpheme boundary and the tendency to retain [ð] before [s] can be seen by considering the word rød-spætte ['ræs,bɛdə] 'plaice', which despite its accent structure as a normal compound is clearly lexicalized (semantically), probably because the second part of the "compound" exists in isolation only with the meaning 'woodpecker'. It should be compared with a possible, but to my knowledge unexploited form like rødspætte constructed as a "woodpecker-compound" like flagspætte, which would most certainly be pronounced with [ð], i.e. ['ræð,sbɛdə], because of its transparent analysis into rød and spætte. (Notice that it will be clearly distinct from rød spætte in a NP like en rød spætte [en 'ræðʔ 'sbɛdə] 'a red woodpecker'.)

Since the deletion of ð before a dental stop (the rule proposed by Rischel) also occurs before perfectly transparent morpheme boundaries (e.g. in fødte [fø:də], preterite of føde), the rule could be formulated like this:

$$ð \longrightarrow ø \;/\; \_\_\_ \;\langle (\#) \rangle \; \begin{bmatrix} -son \\ \langle -sib \rangle \end{bmatrix}$$

1) A form like rædsel [ræðʔsəl] 'horror' might be explained by its long or geminated ð which receives the stød (as opposed to all the other examples which have a short or single ð), since it is derived from the adjective ræd [ræðʔ] 'scared' with stød and short vowel.

(i.e. the rule ignores whether or not the juncture # is present, unless ð is followed by a sibilant, i.e. s). This formulation presupposes that e.g. the genitive ending s is preceded by # , but there is no space here for a discussion of boundaries. The existence of this rule agrees well with the fact that ð is in general not found before any obstruent within the morpheme (the words snedker, bødker 'joiner', 'cooper' are normally pronounced [sne˙ʔgɒ, bø˙ʔgɒ], although alternative pronunciations exist, manifesting a tendency towards "spelling pronunciations" in such cases). Since sequences like ð+p, ð+g, etc. never arise in the concatenation of morphemes within the word (all the relevant endings starting with a sonorant or a dental), the rule has been given the most general environment possible in that it does not mention that the following obstruent should be a dental.

The conclusion is that the non-occurrence of [ð] as the first member of monomorphemic three member clusters is not a special fact about such clusters but a consequence of the mentioned rule with the effect of restricting the occurrence of [ð] before [s] to clearly bimorphemic clusters.

4.2.2. Two member clusters

4.2.2.1. Order restrictions

The endings (relevant to the present discussion) which can be added to a monosyllabic root either contain a vowel, or consist entirely of voiceless consonants. For this reason the

order restrictions of voiced segments in the final part of the stressed monosyllable will be true for both mono- and polymorphemic words. This has the further consequence that it will be revealing to set up as many order classes as possible for voiced segments in order to account for all the order restrictions which exist for Danish speakers (cf. section 3.2.1.), as the following scheme shows:

	I	IIa	IIb	III	
VOWEL	i̯ u̯ ɒ̯	ð	l	m n ŋ v ɣ	VOICELESS SEGMENTS

Note that classes I and II are "natural classes", and that III includes two such classes (cf. section 5. below).

ð is not placed in class I because of the existence of such forms as arbejd! which may be pronounced ['ɑ:ˌbai̯?ð] (together with ['ɑ:ˌbai̯?d]), and similarly the old Latin term for a university grade: haud (illaudabilis) [hɑu̯?ð] (together with the more normal pronunciation [hɑu̯?d]). Uldall (1936 p. 54) quotes the form byrd [byɒ̯?ð] (which is normally pronounced [byɒ̯?d]); the form ending in [ð] is very rare, but there is no doubt that if pronounced it will always be a monosyllable (in distinction to hædr! [hɛð?ɒ] with the reverse cluster, which is generally bisyllabic). It is true of all the mentioned clusters ending in [ð] that they are much more possible than the reverse clusters in true monosyllables.

The distinction between IIa and IIb is only motivated by imperative forms like padl! [pað?l], which are certainly more possible as monosyllabic forms than anything ending in [lð]. However, this may be due to the rules for the pronunciation of the underlying segment /d/ (cf. Rischel 1970 and Basbøll 1972a), and thus need not be decisive of order classes.

The above suggests that the evidence for separating IIa and IIb is rather weak, whereas the separation between I and II (a-b) is quite firmly established, cf. e.g. avl, jarl [ɑu̯?l, jɑ:?l].

Non-nasal sonorants always precede nasals in syllable final clusters, cf. halm, vidn! [hal?m, við?n], and the nasals therefore belong to the order class "after" that of l. The voiced obstruents ([v,ɣ]) never combine with nasals and occupy the same place as the nasals in relation to other non-vowels; they are therefore placed in the same order class.[1] Note that the voiced obstruents are only found after long vowels and after liquids (as a consequence of the phonetic "diphthongization", cf. section 2. above).

Finally, one might wonder why [ŋ] is placed together with the other nasals despite the fact that it is always vowel adjacent (which is Vestergaard's motivation for placing /ŋ/ in his class I). The reason is that [ŋ] is never followed by other voiced segments and thereby agrees with the other nasals (this fact would have to be stated by a special restriction if [ŋ] were placed in class I). But why, then, is it always vowel adjacent? This is due to the fact that [ŋ] is derived from /ng/ (see e.g. Austin 1971 p. 54 f, Basbøll 1972a p. 199 and 1972b p. 11 f for arguments in that direction), and there are never more than two voiced[2] non-vowels in a final cluster (mono- or polymorphemic, see section 4.3.), which excludes the possibility of an intervening voiced segment between the vowel and [ŋ]. This restriction seems to operate on a "higher level" than most of the other restrictions we have discussed, and it may in fact be a morpheme structure condition.

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1) This does not apply to [ð] (cf. vidn! and rødm! [røð?m] which are quite possible and clearly monosyllabic in all pronunciations), and this fact supports our decision to distinguish between [ð] and [ɣ] by a "higher" feature, viz. sonorant, than one which only accounts for their different place of articulation.

2) The /g/ of /ng/ is the same underlying segment which shows up as [ɣ] or [i̯, u̯] in other syllable final contexts, and is probably best described as being underlyingly voiced, as argued by Rischel (1970).

Concerning the voiceless segments, the order restrictions accounting for these can only be described in a very clumsy manner by means of order classes, since we have both sequences like [sg] (fisk) and [gs] (fiks). All the order restrictions operating here can be condensed into the statement that sequences of non-sibilant obstruents end in a dental. This statement permits the following sequences of non-sibilant obstruents: [vd, ɣd, fd, bd, gd] which are all found, and which are the only such sequences (e.g. stout, lægd, loft, recept, vægt). Notice that this restriction applies to both mono- and polymorphemic clusters, and that it is at the same time a restriction on order and on class membership.

4.2.2.2. Other restrictions

The scheme which implies that there are three order classes of voiced non-vowels is clearly over-generating, also with regard to sequences including sonorants. The absence of the "over-generated" clusters cannot in all cases be considered accidental. Thus some additional restriction(s) must be at work here (cf. above on the non-occurrence of [ð] plus obstruent).

In the core of native monomorphemic monosyllables, it is found that all sequences of non-dental non-vowels are /r/-combinations (cf. the end of section 6. where it is pointed out that /r/ in several more respects "counts as" a dental). Within Vestergaard's material (see section 8.), only /mp, mf, ŋk, jk/ violate this criterion. The last-mentioned group /jk/ is only found in the word sheik, which is clearly foreign.

In view of the non-existence of the groups /np, nf, nk/, the other three groups can be derived from an unspecified nasal

followed by /p, f, k/ respectively, by a well-known rule of articulatory place assimilation of nasals before obstruents (it must be noted that in Danish this rule only applies before non-dental obstruents, cf. words like amt, punkt, vams, gængs). Since the maximally unspecified nasal is a dental, the general restriction can thus be claimed to be more generally applicable: not only does it hold for the mentioned nasal-plosive-groups as well as for other groups; it also explains the non-existence of phonetic [np, nf, nk]. Note that the mentioned assimilation rule applies before certain consonants can drop, e.g. a word like sfinks can be pronounced either [sfeŋ?gs] or [sfeŋ?s] (similarly with [sv-]), but never [sfen?(g)s], i.e. the rule must have applied before the optional dropping of the velar stop. Similarly a word like hingst [heŋ?sd] is never pronounced [hen?sd].

If the scope is widened to include foreign words, names, etc., it can be argued that the mentioned restriction only applies to consonants and not to glides, since forms like Hauch, sløjf! [haʊ̯?ɡ, slʌi̯?f] are perfectly possible for Danish speakers (cf. Vestergaard p. 60). This formulation (e.g. finally, non-dental consonants do not combine directly) also removes the necessity of ascribing a special status to /r/. Note that that part of the restriction "sequences of non-sibilant obstruents end in a dental" (mentioned at the end of the preceding section) which is not an order restriction, makes exactly the prediction for obstruents which we have discussed in general in the present paragraph.

Also in the final part of the syllable (cf. section 3.2.2.), it seems to be the case that within the morpheme, aspirates do not combine (remember that only [f, s] and p t k preceded by a short vowel plus /r/ (e.g. vært, kork, etc.) are aspirated in the final part of the syllable, cf. section 2.2.3.). The only exception to that generalization is rts in erts, etc. which may be considered marginal (see section 4.2.1.).

4.3. Polymorphemic clusters

There are a number of Danish suffixes which do not contain any vowel (cf. Spang-Hanssen 1959 p. 204 and Diderichsen 1953 p. 180 ff). Among these there are some (generally non-productive) derivational suffixes making verbs out of non-verbal roots, and consisting of sonorants: l (e.g. samle, cf. sammen), r (e.g. bladre, cf. blad), and n (e.g. blegne, cf. bleg). Since these are not found as suffixes in monosyllabic words except in imperatives, they will be excluded here and only briefly mentioned in section 6.

The remaining ones are (generally productive) inflexional and derivational suffixes composed of voiceless obstruents and beginning with a dental: s, t, st, sk. They have a very restricted mutual combinability, and in general they seem to conform to the following maximal scheme:[1]

Initial consonant (cluster) VOWEL { Single consonant + { (s) t / sk } ; Final cluster ending in s plus plosive ; Other final clusters + t } + s

This seems to be remarkably close to the structure of monomorphemic clusters, but it deviates in the following two respects: (i) any final cluster can be followed by +s; (ii) whereas monomorphemic final three member clusters consist of a sonorant plus s plus a (non-labial) stop, the polymorphemic ones (disregarding final +s) need only satisfy the restriction for their third member and for one of their first two members

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1) An exception is the derivative skælmsk; cf. Diderichsen, loc. cit. + in the scheme indicates morpheme boundaries.

(i.e. their first member may be an obstruent, e.g. glubsk, or they may not have s as their second member, e.g. stærkt); but they should, of course, obey the order restrictions.

The scheme presupposes that identical obstruents are degeminated. It excludes, as it should, sequences like Pingstsk (Diderichsen), aspskt (Vestergaard), and aspskts (Jespersen).

Since all the suffixes in question contain at least one dental, it will be seen that polymorphemic words obey the same basic combinability restriction (mentioned in the preceding section) as monomorphemic words, viz. that non-dental consonants do not combine directly in the final part of the syllable. However, they do not always obey the additional criterion that aspirates do not combine, since there are combinations with +s: hof+s, fork+s, etc.

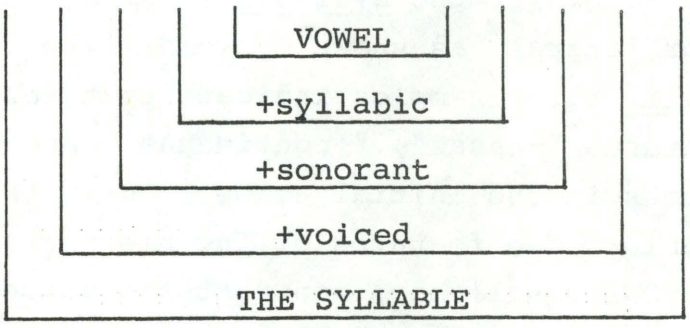
It should be added that the present tense ending ([ɒ̯,ɒ]) forms a syllable by itself except after a vowel (e.g. ser, falder [se·?ɒ̯, fal?ɒ]). Thus its addition to a stem does not create any new consonant clusters.

5. Maximal syllabic structure

In the preceding we have argued in favour of the establishment of order classes which were assumed to be more homogeneous phonetically than Vestergaard's. It is tempting now to compare the insights of sections 3.2.1. and 4.2.2.1., and to try to generalize the results to a hypothesis on syllabic structure in Danish, applying at the "level" discussed in section 2.1. It will be the maximal syllabic structure, where the term "maximal" both implies that the syllable is stressed and that the vowel is short (long vowels having a much more restricted repertoire of consonant clusters after them). If either of these criteria for "maximality" is not

satisfied, the "maximal syllabic structure" model in a way still applies, but then it presupposes additional restrictions (to those mentioned in the preceding sections), i.e., it will then be vastly over-generating.

The syllable will thus be postulated to have the following "hierarchical" structure:



The figure should be read as follows: The peak of the syllable is the vowel. The vowel and possible adjacent glides constitute the syllabic part of the syllable. The syllabic part of the syllable together with possible adjacent non-syllabic sonorants constitute the sonorant part of the syllable. The sonorant part of the syllable together with possible adjacent voiced obstruents constitute the voiced part of the syllable. And, finally, the voiced part of the syllable plus possible adjacent voiceless consonants constitute the syllable (or syllabic theme, in Hjelmslev's terminology). It is evident that in concrete cases the extent of contiguous (in the "hierarchy") features can be identical.[1] This amounts to the following hypothesis on the Danish syllable (and that is where the "hierarchical" nature of the model comes in): The following "implication chain" holds true without exception: vowel $\supseteq$ [+syllabic] $\supseteq$ [+sonorant] $\supseteq$ [+voiced] and, similarly, the chain with switched $\pm$values holds true in the opposite direction:
[-voiced] $\supseteq$ [-sonorant] $\supseteq$ [-syllabic] $\supseteq$ non-vowel.

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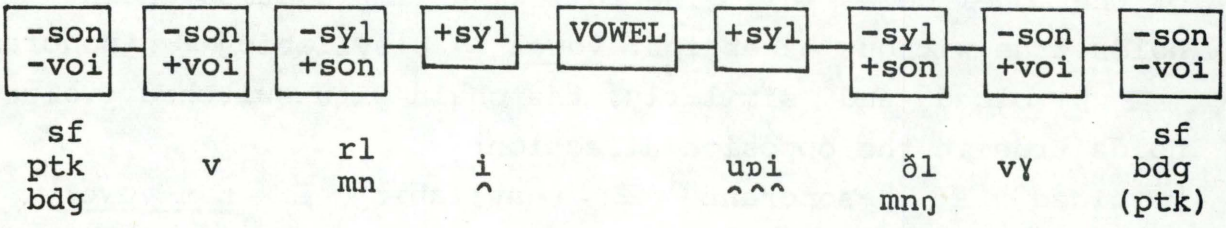
1) e.g. in the word kat, the voiced part, the sonorant part, and the syllabic part all equal the vowel a.

This is the reason why we should not insert features like "nasal", "continuant", and "lateral" in the model, although it holds true that within the sonorant part of the syllable the center is non-nasal and continuant, and the margin nasal and non-continuant, and that within this non-nasal center the center is non-lateral and the margin lateral. For it is not true that the margin of the syllable is always nasal and non-continuant, or lateral, as shown by words like fnat, flamsk, plejl, halm. Such examples indicate that the distribution of the features "-nasal", "+continuant", and "-lateral" can be discontinuous in the initial as well as in the final part of the syllable. The features of the hierarchy, on the other hand (i.e. VOWEL, syllabic, sonorant and voiced), can never be discontinuous in the syllable, neither in their positive nor in their negative values.

In fact, the claim is that the features of the "hierarchy" are distributed around the peak of the syllable, so that each feature may spread continuously over several segments in the way indicated by the hierarchy. This could be formulated so that "one instance of" e.g. the feature [+sonorant] "belongs to" several segments at the same time.[1]

But our hypothesis on syllabic structure does not end here. This syllable model also explains (in a vague sense) nearly all of the observed order relations in the monosyllable. In fact, the hierarchy is, in all relevant respects, a notational variant of the following scheme which expresses the order relations more directly:



1) This was, in fact, Stephen Anderson's conclusion concerning the feature "syllabic" (but he did not include any of the other features of our "hierarchy" in his discussion, cf. section 2.2.1. above).

It will be seen that this scheme correctly predicts the order of any permitted (unordered) set of either initial or final voiced non-vowels with the reservation that in the final part of the syllable, non-nasal sonorants precede nasals. The order of voiceless consonants conforms to the following principle (which in fact excludes all wrong orderings of such consonants): in the initial part of the syllable, only /s/ may precede a voiceless consonant, and in the final part of the syllable, any sequence of non-sibilant obstruents ends in a dental.

Note especially that none of the order classes predicted by the model is "descriptively" superfluous. Moreover, as we saw in section 4.2.2.1., the restriction on final clusters that "non-nasal sonorants precede nasals" becomes a direct consequence of the order class model if nasals are taken to "belong to" the order class of voiced obstruents instead (syllable initially such a "readjustment" of the order classes will have no substantial consequences, see section 3.2.2. above). However, such an order class consisting of nasals and voiced obstruents can hardly be said to be a "natural class"[1] (except in the vague sense that both voiced obstruents and nasals form a somewhat "less peak-forming" class of voiced segments in distinction to the continuant sonorants, but this intuition may be of a circular nature, viz. depending on distributional knowledge), and I find this a very serious objection to such an alteration of the model.

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1) Of course the class of nasals and voiced obstruents can be given a common definition in distinctive features when using Greek letter variables, viz. as [α sonorant, -α continuant, +voiced], but this seems to me completely "hocus-pocus" (one should probably in principle refrain from using such variables when defining "natural classes", cf. Wheeler 1972 p. 90 f).

Everything which has been said so far in this section applies both to mono- and polymorphemic monosyllabic words (see section 6. on polysyllabic words). Notice that in order for the model not to be over-generating, the general restrictions discussed in the preceding sections also apply here, of course (monomorphemic clusters contain at most three non-vowels, and if there are three, exactly one of them is voiced, etc.).

6. Medial clusters

The material of this section is furnished by the infinitive forms of Danish verbs registered in Dansk Rimordbog (2nd edition, Politiken 1963). It turned out that all medial clusters in this material (i.e. sequences of non-vowels between the stressed vowel and the word-final shwa) could be described as consisting of a possible monomorphemic final cluster or of such a cluster plus one of the non-vowels /l, r, n/. This was true regardless of whether postulation of a morpheme boundary before /l, r, n/ was possible (cf. angre without a morpheme boundary before r,[1] but blomstre with a morpheme boundary before r, cf. blomst).

It should be pointed out that the (phonological) syllable boundary need not go directly before /l, r, n/. For example, fordre and hærde have the syllable boundary before d, which is therefore pronounced (as a plosive) and not deleted, but they conform to the general structure (concerning medial clusters) only if the "final" cluster is considered to be rd (cf. Basbøll 1972a p. 199 f).

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1) However, the consonantal manifestation of /r/ shows that the syllable boundary goes before r. (Actually, this is a better example of the importance of "Hjelmslev's law" for syllabification - viz. that the syllable boundary must go before r since ŋr is an impossible termination of a Danish monosyllable - than the one given in Basbøll 1972a p. 187 (Ad (B)).

Only very few of the registered final clusters in Vestergaard 1967 (cf. section 8.) fail to occur medially in the material (with or without a following /l, r, n/). Those which do not are probably accidentally missing except in a few cases where the "original" cluster is so rare that no conclusions on accidental vs. systematic non-occurrence can be drawn ("sporadic occurrence" in Spang-Hanssen's terminology, cf. [ɣd, ŋd, msg], some of which may occur in inflected forms like hængte, lumske, as mentioned in the end of the present paragraph). On the other hand, according to our section 4.2.1. it is no accident that three member clusters consisting only of voiceless consonants (Vestergaard's /psk, kst, tsk/) never occur medially in monomorphemic words (with or without a following /l, r, n/): it is simply because such clusters are not monomorphemic (but it is evident that final clusters can generally be turned into medial clusters by adding an ending which starts with shwa, but then there will, of course, always be at least one morpheme boundary between the stressed vowel and shwa).

Medial clusters may also throw light upon the distinction between accidental and systematic gap in another way: certain medial clusters may fill accidental holes in final combinations (e.g. sløjfe, strejke, dogme, sødme).

Finally, one class of deviating medial clusters should be mentioned, viz. examples like balje, midje, linje. Since j does not belong to the class /l, r, n/, and since final groups like lj, ðj, nj seem to be systematically missing in monosyllables, we should look for another explanation. We propose that j be derived from the vowel i which is thus "reduced" in the position between a consonant and shwa. This rule cannot be shown invalid by means of examples like villige [viliə], commutable with [viliə], since villig should end underlyingly in shwa plus a high consonant (a /ɣ/ or the like), cf. Eric P. Hamp's proposal that the derivative ending ig be derived from /əj/ (unpublished hand-out).

The existence of the class /l, r, n/ (which is well established, cf. Diderichsen, loc. cit.) confirms the claim that r in some respects "counts as" a dental (since the segments in question are then exactly those of the initial non-vowels which are sonorant and dental, and in the position in question /l, r, n/ are of course syllable initial). Further, it could be added that r is the only non-vowel which is phonetically non-dental and occurs in the final part of shwa-syllables (the others are [s, d, ð, l, n], i.e. the entire set of final dental consonants), which supports the same conclusion. (It is well known that r is historically derived from a dental.)

7. Conclusion

In the present notes we have tried to find and discuss some principles which can be said to account for systematic restrictions in Danish consonant combinations.

Most importantly, it was found that nearly all order restrictions could be explained by reference to a very general model of maximal syllabic structure in Danish, applying at a level near the phonetic surface (but not identical to it; cf. the rather unexplored notion of "shallow phonological structure", which may be relevant here), see section 5.

We have also found some further restrictions which are not quite identical in initial and final position, but nevertheless exhibit a high degree of parallelism: There are at most three non-vowels in monomorphemic initial and final clusters, and if there are three, exactly one of these is voiced whereas the others are s plus a plosive; furthermore, aspirates do not directly combine within the morpheme, neither initially nor finally.

Some further non-combination rules have been discussed, and the basic rules may be formulated as follows: (i) initially, homorganic consonants do not combine, whereas (ii) finally, non-dental consonants do not combine directly (that the restrictions are really different can be seen by comparing the excluded initial groups dl, tl with the perfect final group lt [ld]). This latter restriction seemed to apply on a rather "high level" compared to the other restrictions (since groups like [ŋg, mf] were explained as being derived from /nk, nf/), possibly it is some kind of a morpheme structure condition (in distinction to this, cf. that [ŋ] seems to "count as" one velar segment in the final group [ŋsd]). The non-occurrence of [ð] before obstruents belonging to the same morpheme is probably due to a morpheme structure condition too. (We have not discussed the extent to which such morpheme structure conditions could or should be viewed as "blank filling rules", nor other questions concerning the relation between the present distributional survey and different models of generative phonology and morphology.)

Whether distributional facts, for example of Danish, should after all be described as we have tried to outline, viz. partly as due to morpheme structure conditions, partly (and this aspect was particularly emphasized in the present paper) as due to general principles of syllabic structure on a rather phonetic level of description, is of course a completely open issue. But at least I think it should be interesting to investigate further (and hopefully less superficially) into these matters.

8. Appendix: Vestergaard's material

For ease of reference of the reader, Vestergaard's examples of each cluster are reproduced here, in his phonemic notation and in the order in which he gives them.

8.1. Initial clusters (p. 40 f)

Two consonants

/sj/ sjæl	/fr/ frem	/sv/ svær
/tj/ tjørn	/dr/ drik	/tv/ tvær
/pj/ pjat	/br/ brun	/kv/ kvik
/kj/ kjole	/gr/ grov	/dv/ dværg
/fj/ fjols	/vr/ vred	/sn/ sno
/dj/ djærv	/sl/ slag	/kn/ kno
/bj/ bjørn	/pl/ plads	/fn/ fnat
/gj/ gjord	/kl/ klo	/gn/ gny
/mj/ mjød	/fl/ fløjl	/sm/ smal
/tr/ træ	/bl/ blandt	/st/ stå
/pr/ præst	/gl/ glad	/sp/ spå
/kr/ kro		/sk/ skal

Three consonants

/str/ strå	/stj/ stjært	/skv/ skvat
/spr/ spring	/spj/ spjæld	/spl/ splint
/skr/ skrog	/skj/ skjold	

8.2. Final clusters

Two consonants (p. 51 f)

/rl/ jarl	/lf/ alf	/jk/ sheik
/rp/ skarp	/ls/ hals	/jn/ degn
/rt/ vært	/mp/ damp	/js/ majs
/rk/ værk	/mt/ amt	/jl/ gøgl
/rg/ dværg	/mf/ trumf	/gt/ lægd
/rm/ arm	/ms/ vams	/gn/ vogn
/rn/ ørn	/ŋt/ punkt	/gl/ hagl
/rv/ arv	/ŋk/ flink	/ft/ gift
/rf/ skærf	/ŋs/ gængs	/pt/ recept (tabt etc.)
/rs/ vers	/nt/ splint	/ps/ gips
/lp/ skalp	/ns/ dans	/ts/ skyts

/lt/ filt	/vt/ stovt	/kt/ vægt
/lk/ folk	/vn/ ovn	/ks/ straks
/lg/ valg	/vs/ snavs	/sp/ bisp
/lm/ halm	/vl/ svovl	/st/ hest
/lv/ ulv	/jt/ sløjd	/sk/ flæsk

Three consonants (p. 57)

/rst/ tørst	/lsk/ falsk	/nst/ kunst
/rts/ erts	/lft/ tylvt	/vst/ provst
/rft/ værft	/mst/ blomst	/jst/ gejst
/rsk/ harsk	/msk/ lumsk	/psk/ glubsk
/lkt/ mulkt	/ŋst/ hingst	/kst/ takst
/lst/ svulst	/nsk/ dansk	/tsk/ skotsk

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