‘Egg, Onion, Ouch! On the Representation of Dutch Diphthongs’

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Egg, onion, ouch!
On the representation of Dutch diphthongs

Wim Zonneveld and Mieke Trommelen

> It is hard to read the stubborn attacks on this problem without feeling that since it evidently does not lend itself to a traditional phonemic solution at all, application of an entirely different phonological theory will some day make it evaporate (Shetter, 1972: 1390).

1. Introduction

The phonological component of a transformational-generative grammar is defined by a set of (partially) ordered rules which link the underlying phonological representation (ideally the output of the syntactic component of the grammar) to the surface phonetic representation (ideally the set of nerval instructions to the speech mechanisms). While logically this linking function of the phonological component could take any form, it was established from the very outset of generative phonology that this form is in fact a very natural one. Generative phonologists expressed this naturalness not, for instance, by limiting the sheer number of rules allowed to appear in any single phonological component - although this is logically a not at all implausible initial hypothesis - but rather by constraining the *types* of rules that could appear in these components. Thus, Postal (1968) proposed that only *maximally general* phonological rules appear in the phonological component of any grammar, by dint of his so-called Naturalness Condition:

(1)
Naturalness Condition: The underlying representation of a form equals its surface phonetic representation, unless one has a reason (a *generalization*) to deviate.

While the Naturalness Condition as such constitutes an enormous limitation on the power of generative phonology, it is also clear that in effect it defines a direction for generative phonological research. Since non-

general phonological rules will be disallowed, generative phonological research will be the study of what constitutes a generalization within the domain of generative phonology. This effect of the Naturalness Condition is reflected directly in the so-called Abstractness Controversy, initiated by Kiparsky (1973a), which has led to several additions to the Naturalness Condition, most notably the Alternation Condition of Kiparsky (1973a), revised in Kiparsky (1973b). This condition removes apparently very general rules of certain types (rules of so-called 'absolute neutralization') from the set of possible generalizations in generative phonology. It will not be our aim, however, to enter in this paper into the discussion on the abstractness conditions on phonological analyses. Rather, the nature of the relation between underlying and phonetic representations within generative phonology has been worded in this introduction in terms of the Naturalness Condition (1) because we intend to discuss here a partial phonological analysis of Dutch, apparently paradoxical in terms of the Naturalness Condition, where the phonetic representation of a small and coherent set of sounds is comparatively irrelevant to phonological analysis. More precisely, we will be concerned here with a set of sounds whose precise phonetic characteristics are complex and to some degree open to debate, while at the same time we will show how phonological analysis of these sounds can be carried out fruitfully in ignorance of and independently of this complexity and debate. Possibly not surprisingly, the set of sounds we will deal with is the set of Dutch diphthongs. In the vein of our aims as expressed above, we will give in section 2 below an overview of the traditional, and more sophisticated phonetic analyses proposed for these diphthongs. In section 3 we will give a brief survey of the various interpretations attached to the Dutch diphthongs by pregenerative structural phonologists, who were, of course, limited comparatively severely in their possible deviations from the phonetic surface. Finally, in section 4 we will carry out an analysis of part of the phonology and morphology of Dutch in order to show that within generative phonology underlying representations of these diphthongs can be arrived at comparatively independently of their phonetic characteristics.

2. Phonetics

A survey of the developing views of the phonetics of the Modern Standard Dutch diphthongs may be subdivided roughly into three periods. The first period runs up to 1940 and includes both the descriptions of the early

pre-1920 impressionistic phoneticians, and the much more detailed experimental studies reported on in Zwaardemaker and Eijkman (1928), Blancquaert (1934), and Eijkman (1937). The second period runs up to 1960 and includes the experimental investigations reported on in Kaiser (1943, 1948, 1950). Finally, the third period comprises the experimental phonetic investigations executed in the sixties at the Instituut voor Perceptie Onderzoek at Eindhoven by Cohen and associates, and at the University of Amsterdam by Mol et al.

With regard to diphthongs, Modern Standard Dutch can be taken as the period starting immediately after the collapse of the three velar diphthongs, first '*aau*' and '*au*' then '*au*' and '*ou*'. For all intents and purposes these developments may be situated around or just prior to the turn of the century. Thus, the last grammarian to recommend different pronunciations for '*au*' and '*ou*' is Den Hertog (1911: 197).

In almost all early phonetic descriptions between 1900 and 1940 the Dutch diphthongs are grouped together in a large class comprising, in their respective spellings, those in (2).

(2)

ieuw	as in	*nieuw*	'new'
eeuw		*leeuw*	'lion'
uw		*duw*	'push'
oei		*boei*	'buoy'
ooi		*kooi*	'cage'
aai		*baai*	'bay'
ei		*kei*[1]	'boulder'
ui		*lui*	'lacy'
ou		*kou*	'cold'

As regards a first generalization, as far as we have been able to make out most early analysts agree that these diphthongs consist of two parts, 'two vowels within one syllable', one passing into the other, where the former is strongly articulated, and the latter weakly articulated. They are, therefore, 'falling' diphthongs. Furthermore, in most descriptions these diphthongs are classified as in (3), where the criterion for classification is the frontness (vs. backness) of the second element.

(3)

oei	*ieuw*
ooi	*eeuw*
aai	*uw*
ei	*ou*
ui	

Such a classification is presented in one form or other in, for instance, Kruisinga (1913), Roorda (1919), De Froe (1922), Zwaardemaker and Eijkman (1928), Blancquaert (1934), and Eijkman (1937), although Zwaardemaker and Eijkman, in their detailed studies, provide a further classification according to the relative height of the first element, as in (4).

(4)

oei	[*uɪ*]	*ieuw*	[*iu*]
ooi	[*oɪ*]	*eeuw*	[*eu*]
		uw	[*yu*]
aai	[*aɪ*]	*ou*	[*ɔu*]
ei	[*ɛɪ*]		
ui	[*œɪ*][2]		

The coordinates of the phonetic symbols in (4) can be read from tables in Zwaardemaker and Eijkman (1928: 157) and Eijkman (1937: 77), which may be represented with some presently irrelevant omissions as in (5).

(5)

	back	mid	front
closed	*u*		*y i*
half-closed	*o*		*e*
half-open	*ɔ*	*œ*	*ɛ*
open		*a*	

The half-open vowels are relatively short, while the other vowels gain length from top to bottom. The latter all occur independently in non-diphthongic environments as in the words of (6),

(6)

[*buk*]	*boek*	‘book’	[*dif*]	*dief*	‘thief’
[*bot*]	*boot*	‘boat’	[*bek*]	*beek*	‘brook’
[*man*]	*maan*	‘moon’	[*ny*]	*nu*	‘now’

while among the half-open vowels [*ɔ*] and [*ɛ*] in diphthongs are slightly more open than the vowels occurring independently in Dutch words such as [*pɔt*] *pot* ‘pot’, and [*mɛt*] *met* ‘with’. Finally, [*œ*] is described in Zwaardemaker and Eijkman (1928: 154-5) as slightly more open than the vowel which occurs independently in a longer version in some loanwords such as *freule* ‘lady’ [*frœ:lə*], while Eijkman (1937: 74) describes it as slightly more closed than that vowel. The latter part of *ui* is slightly rounded, although heavily so in closed syllables: [*hœys*] *huis* ‘house’.

The remaining early descriptions differ from Zwaardemaker and Eijkman's only in detail. Kruisinga, Roorda, De Froe, and Blancquaert simply

describe [ɔ] and [ɛ] in diphthongs as the vowels of *pot* and *met*. There are some subtle differences, however, in the various descriptions of *ui*, with different interpretations as to the height of the first half, and the roundness of the second. Scharpé (1912) gives 'half open followed by non-round' [*œj*];, Kruisinga (1913) gives 'open followed by non-round' [*ɐi*]; Roorda (1919) 'mid followed by rounded' [*ui*]; Muller (1921) 'half open mid followed by non-round' [*öi*]; De Froe (1922) 'high mid followed by rounded' [*öy*]; and Blancquaert 'half-open half-long followed by round' [*œ.y*] (for Blancquaert the first half of these diphthongs is 'half-long'), where none of these authors notes a difference between open and closed syllables.[3] Finally, a comparatively idiosyncratic description (but see below) of *ei, ui, ou* is given by De Groot (1931a), in particular where he notes that the second halves of these diphthongs will not be necessarily completely 'closed':

(7)

> Anfangs ist er dumpf und hat einen mäβig hohen Unterformanten; dann geht er über in einen etwas helleren Klang, nähert sich aber gleichzeitig dem nächstliegenden hellen Vokal der niedersten Unterformantenreihe. Also phonetisch etwa:

ou	=	(*ó oder ɔ*)	+	(*o oder u*)	
ui	=	*œ*	+	(*ø oder y*)	
ei	=	(*ɛ oder E*)	+	(*e oder i*)	(119).

After these 'early' descriptions of the Dutch diphthongs, an extremely detailed 'sociophonetic' study was undertaken by Kaiser and associates in the forties. A report of the study was laid down in Kaiser (1943), and a brief excerpt on diphthongs appeared as Kaiser (1948). Kaiser found by studying oscillograms that within (4) *ei, ui, ou* can be set off against the others in that the first halves of the diphthongs in the latter group resemble closely the vowels occurring independently as in (6) in their respective formant frequencies, while the deviation from the vowels in *pot, freule*, and *met* is much more obvious for the first halves of the former group. As regards the second halves of the diphthongs *ei, ui, ou*, Kaiser argues that the concern with the quality of this part, as instanced also above, is to some degree exaggerated. In particular she states:

(8)

> In the vowels various formative parts are found which, though they are distinguished quantitatively as principal and minor parts, are not looked upon as qualitatively different. On the ground of an extensive examination of the vowels of a few hundreds of Amsterdam under-

> graduates it seems correct to distinguish a resonatory component (the lower formative part) and an articulatory component (the higher formative part) in the vowels. The resonatory component is formed in a space of which the pharynx forms a considerable part…. If one examines the articulation of the diphthongs *ei, ou, ui*, by means of palatograms, then it is surprizing how the place of contact on the palate does not remind to the slightest degree of the articulation of the second element, at least if one has to do with unconcerned speakers, for it is quite easy to pronounce the second component intentionally, as mostly happens in declamation. It seems to me that in the second part of the diphthongs mentioned, exclusively the resonatory component is relevant. Towards the end of the diphthongs one passes over into another, lower, resonatory sound, but does not trouble about the articulatory component. Therefore it is not important whether in the case of *ui* one represents this component as *ie* or as *uu*, for these two have the same resonant component and distinguish themselves exclusively articulatorily, as for the matter of that also *oe* has the same resonant sound. (1948: 303-4)

In 1943:32 Kaiser adds that the change in the resonatory formant in the three diphthongs is from 640 to 320 Herz, figures which will crop up again further on below. Moreover, she finds that for all diphthongs inspection of the relevant oscillograms

(9)

> gave the impression that instead of an indefinite number of gradually changing patterns as has been supposed by some phoneticians, two different patterns characteristic for the two parts of the diphthongs are to be recognized. In the majority of cases on the limit of both parts a few vocal periods bear a special character, which usually may not be considered as a simple transition between both principal patterns. The amplitude is smaller than that of either part. Often there are extremely high components visible and probably in connection therewith a high degree of decrement. In a few cases the vocal period became indiscernable. It seems as if a short of hiatus is present (as in a more developed form it is the case between two vowels which are prohibited to form a diphthong, in Dutch occurring only in foreign words)…. It happened especially in closed syllables that only two parts were recognizable, each of the three parts but most frequently the last part, being absent now and then. (1943: 32-3)

Thus, for instance for the three words in (10), averages for the three component parts of the respective diphthongs for 27 speakers were roughly as given (in hundredths of a second).

(10)

bij	'bee'	[*bɛɪ*]:	15	2.5	10
vijf	'five'	[*vɛif*]:	10	3	5
baai	'bay'	[*baɪ*]:	20	3	10

As pointed out by Stutterheim (1962: 31), Kaiser's segmentation of the Dutch diphthongs into three parts has not been an issue in the subsequent research into the subject. For instance, her findings were disregarded completely in the two most important post-war handbooks on Dutch phonetics and (structural) phonology, Van den Berg's *Foniek van het Nederlands* (1959), and Cohen et al.'s *Fonologie van het Nederlands en het Fries* (1959). These works merely provide concise summaries of the pre-war 'early' literature, the latter reiterating in particular Zwaardemaker and Eijkman's results, while the former simply lumps together all views, apparently not worrying whether some of these are mutually compatible at all.

However, in the sixties work done by the IPO-group at Eindhoven and Mol et al. at the University of Amsterdam provided a follow-up to Kaiser's research. The IPO-investigations are reported on in Cohen (1961), Slis and Van Katwijk (1963), 't Hart (1969), and Cohen (1971). In the experiments, the diphthongal characteristics were investigated of the groups of vowels, or of (combinations of) vowel-like sounds in (11).

(11)
(i) *ei, ui, ou*
(ii) *i, y, u, e, ø, o, a*
(iii) *ieuw, eeuw, uw, oei, ooi, aai*

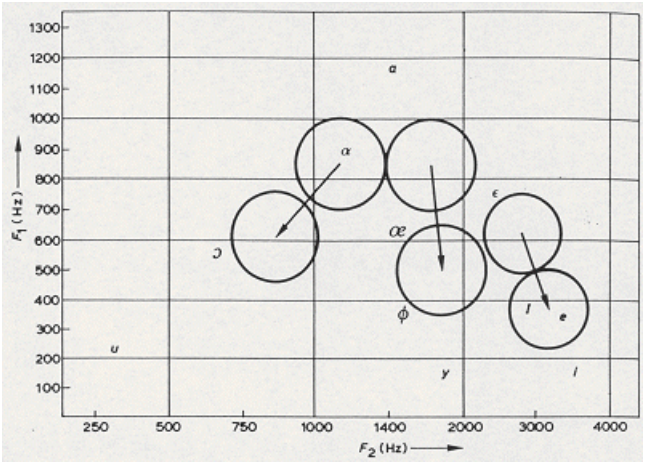
and the results were as follows.

As regards group (i), experiments of several kinds were described. Segmentized stretches of speech of increasing and subsequently decreasing length gave, on listening, for *ei*: '*ɛ - ɛi - i* or *I*', and similarly for the other diphthongs, with no perceivable sound in between the two extremes. Segmentized stretches of natural speech of equal length, shifting through the diphthongs 'from left to right', gave the impression of a gradual change of colour. Synthetic diphthongs consisting of the separate components *ɛ+i*, *ʌ+y*, and *ɑ+u* gave, upon listening, the impression of acceptable versions of the diphthongs *ei, ui*, and *ou*.

In an experiment described elaborately both in Slis and Van Katwijk (1963), and 't Hart (1969), synthetic speech was offered to subjects who were to give rates on a scale between purely monophthongal and purely diphthongal (allowing for unintelligible stretches), and where for two-componential diphthongs both halves were varied as to their respective F_is and F_2s. Slis and Van Katwijk found that for *ei, ui, ou* there is a high

degree of tolerance as regards the starting point of first halves, where the direction towards the second halves is relatively narrowly defined. This can be laid down in the slightly simplified picture in (12) below.

(12)



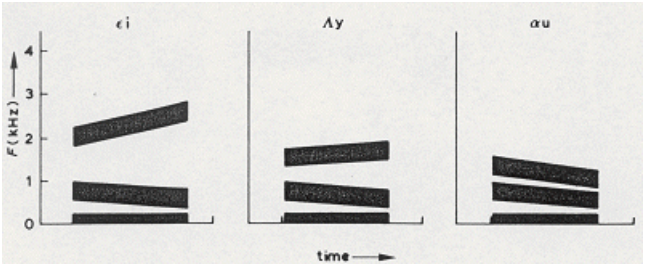
The results of the synthetic speech experiment were checked with a natural speech experiment. It was found with the help of a segmentator that in natural speech the length of the traject from starting point to terminus slightly exceeded that of synthetic speech: [*ɛ* > *ɪ*], [*ʌ* > *ø*], and [*ɑ* > *ɔ*]. The results of the experiment are described in 't Hart (1969) as follows:[4]

(13)

… the [*ɛi*] is: the Dutch vowel [*ɛ*], followed by a *movement in the direction of* [*i*]; the [*ʌy*] is the English vowel [*ʌ*] (of 'cup') - and not Dutch [*œ*] - followed by a *movement* to [*y*]; [*ɑu*] is the Dutch vowel [*ɑ*] - and not [*ɔ*] - followed by a *movement* to [*u*]. The terminals are reached only in overly correct, isolated speech, in word-final position, and in this case are [*i*], [*y*], and [*u*]. Normally one finds as terminals [*ɪ*], [*ø*], and [*o*]. (172)

Further illustrations of (12) and (13) are provided by the spectrograms from Nooteboom and Cohen (1977:62) paraphrased here in (14).

(14)

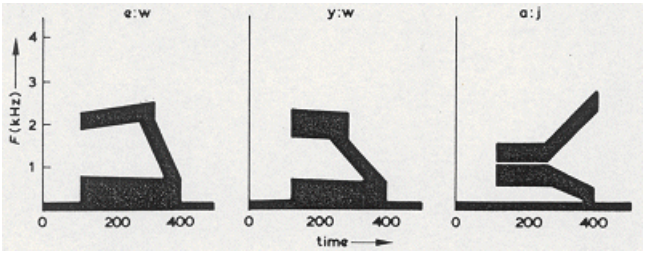


Slis and Van Katwijk (1963) note also that their observation on the relative obligatoriness of the direction of the change between the two component parts of the diphthongs *ei, ui, ou* falsifies Kaiser's claim that only the fall of F_1 is perceptually important, and not so the exact correlates of F_1 and F_2 of the second half.

For the vowels of (11ii) (which, parenthetically, contains (6)), the IPO-investigators found that these are diphthongic as well (i.e., show a change of F_1 in the second half), but they differ from the diphthongs of (11i) in two ways. Firstly, synthetic versions of these vowels did not *require* a second component in order to be still perceivable as the same vowels. Secondly, as opposed to the diphthongs, these vowels require a rather narrowly defined initial range of F_1-F_2 correlates, with a subsequent high amount of tolerance for the direction of the F_1 fall. It was also found that before *r*, where phonetically the diphthongs of (11i) do not occur, the vowels of (11ii) lengthen in a very specific way. Thus, [*a*] goes to *r* via [*ɛ*], while the other vowels go via [*ə*].

Finally, for the diphthongs of (11iii) it was found that these also were characterized by a change, from an independent vowel contained in (6) *towards i/j*, or *u/w*, although through technical limitations the exact coordinates of the traject towards the latter could not be ascertained accurately. However, some further idea as to the properties of these diphthongs may be gained from the spectrograms provided in Nooteboom and Cohen (1977:62), paraphrased here in (15).

(15)



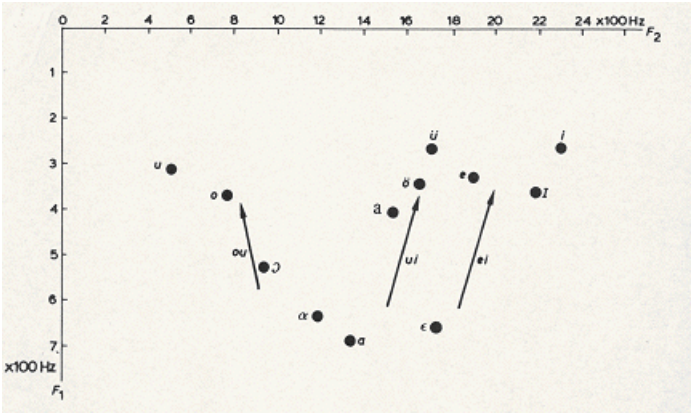
The results of the IPO-group summarized above tally to a considerable degree with those reported on in Mol (1969). He describes an experiment in which a 0.3 second *ei* diphthong was cut into three equal parts. The result was the perception of '*ɛ - ɛi - e*'. Furthermore, Mol describes the articulatory aspects of the diphthongs as follows:[5]

(16)

> When the pronunciation of the diphthong starts, the speech tube may be represented by two tubes, one wide in the oral cavity, and the other narrow in the pharynx. This is the so-called GEMINI-model. During the pronunciation of the diphthong, the *oral tube* is constricted in the middle in the form of a diabolo. A hardware model of this mechanism, driven by an artificial larynx, produces a clearly recognizable diphthong. Which of the three diphthongs is created depends on the length of the oral tube, which is different for each of the diphthongs. (163)

In terms of F_1 and F_2, Mol's description implies that F_2 characterizes the nature of the diphthong, while F_1 decreases 'tumultuously' during the articulation of the diphthong. Plotted in a vowel diagram, Mol's results may be represented as in (17), which may be compared with (12) above (Mol, 1969: 166).

(17)



Notice that (17) confirms rather accurately the figures given for the fall of F_1 by Kaiser (1943).

3. Structural Phonology

Within the framework of Dutch structural phonology, as it was established under the impetus of the Prague linguistic school in which some Dutch scholars played a major role, the single most-discussed topic is no doubt that of the proper representation of the Dutch diphthongs *ei, ui*, and *ou*. In fact, the participants in the discussion were concerned with two issues. Firstly, there were different views on the mono- vs. biphonematic status of these diphthongs, and secondly, among those who favored the monophonematic interpretation, there was some argument as to whether these diphthongs should be included among the 'long' vowels, or should be considered a separate class of phonemes on their own. The most important literature may be summarized as follows.

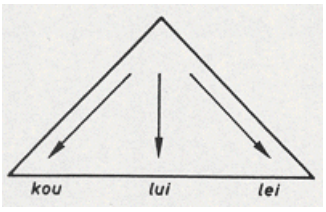
The first statement on the diphthongs of Dutch within the framework of structural phonology is by De Groot in his 1931 contribution to the *Travaux du Cercle Linguistique de Prague* 4, and in his 1931-2 articles in *De Nieuwe Taalgids*. In these papers, a description of the vowel system of Dutch emerges with the following properties. The system has three subsystems, those of the 'clear' vowels (traditionally: 'long') as in (18a); those of the 'dull' vowels (traditionally: 'short') as in (18b) (cf. De Groot, 1931a: 233-7),

(18)

	(a)	
	baat	
boot	*leut*	*beet*
boet	*bruut*	*biet*
	(b)	
pad		*pet*
	put	
pot		*pit*

where relative heights and the degrees of backness are based on the phonetic investigations by Zwaardemaker and Eijkman. The third sub-system comprises those vowels which undergo a change of 'colour' during their period of articulation, i.e. the diphthongs of (11i) as in (19).

(19)

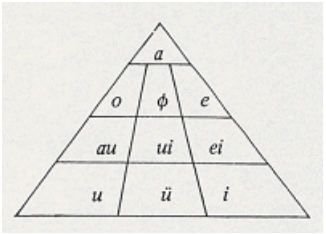


The diphthongs of (19) are phonemically units. The fact that the first

half of *ui* [*œy*] does not occur independently in the language argues for De Groot that *ui* is a phonological unit, while the fact that *ei* and *ou* have precisely the same internal structure as *ui* argues that these too should be looked upon as single phonemes. Among the 'dull' vowels De Groot posits a separate class of 'long dull' vowels, occurring only in loanwords such as *rose* 'pink' [*rɔ:zə*], *freule* 'lady' [*frœ:lə*], and *serre* 'sun-lounge' [*sɛ:rə*]. Finally, De Groot considers (without further elaboration) the phonetic diphthongs of (11iii) as phonologically two phonemes each, where the components are found among the 'clear' vowels.

Up to a considerable degree, Van Ginneken (1931, 1934) agrees with the 1931-2 analysis by De Groot. Firstly, since the separate parts of the (11iii) diphthongs can all occur independently, these diphthongs are phonologically biphonematic. Secondly, he agrees with De Groot's division of the monophthongic vowel system into two subsystems as in (18), although he replaces De Groot's 'clear' vs. 'dull' by 'unchecked' vs. 'checked' which, according to a footnote (354), equal Sievers' 'schwachgeschnitten' vs. 'scharfgeschnitten'. Thirdly, he agrees that *ei, ui, ou* are monophonematic diphthongs, since their component parts do not occur independently. However, as opposed to De Groot, Van Ginneken does not include these diphthongs in a separate triangle, but places them among the 'unchecked' vowels, where *i*: *ü*: *u* and *e*: *ö*: *o* show the same correlation of front-nonround: front-round: back as among the diphthongs *ei*: *ui*: *ou*. Thus, Van Ginneken assumes the triangle of (20) by the side of (18b).

(20)



In his 1939 monograph *Phonologie, een hoofdstuk uit de structurele taalwetenschap*, Van Wijk, the third great Dutch pre-war structuralist phonologist, agrees completely with Van Ginneken, although his arguments are more clearly articulated. Firstly, he argues that the (11iii) diphthongs are biphonematic because, if a vowel follows as in (21) the second halves of the diphthongs become parts of the second syllable, which shows that these diphthongs consist of two parts:

(21)

nieuw	'new'	*nieuw-e* (attr.)	*ni-wə*
leeuw	'lion'	*leeuw-en* (pl.)	*le-wə*
groei	'grow'	*groei-en* (infin.)	*ɣru-jə*
gooi	'throw'	*gooi-en* (infin.)	*ɣo-jə*
fraai	'beautiful'	*fraai-e* (attr.)	*fra-jə*

Moreover, the initial elements of the second syllables are consonantal, which argues that the final halves of the diphthongs when word-final, although phonetically vowel-like, are combinatory variants of the consonantal phonemes which occur initially in *ja* 'yes', *jaar* 'year', *wie* 'who' *wat* 'what', and so on. Secondly, the diphthongs *ei, ui, ou* are phonologically monophonematic, not because their parts do not occur independently (since in this case they could be combinatory variants of phonemes occurring elsewhere), but rather because they are 'unzerlegbar', i.e. they characteristically show a gradual change from one vowel into another. This gradual connection is not interrupted when a vowel follows, as in *kei-en* 'boulders', and *bouw-en* 'to build', where the syllable division equals the morphological division. Furthermore, these diphthongs belong in one system with the vowels of (18a) since they share the property of being 'schwach-geschnitten': they are allowed to reach their sonority-peak freely. As one of the results of this property, both kinds of vowels are allowed to stand in a final open syllable, as opposed to those which are 'scharf-geschnitten', which characteristically occur in closed syllables, as in (18b).

As opposed to the above analysis, Van Wijk in his 1939 article in *De Nieuwe Taalgids* retreats slightly on his own steps in admitting that upon reconsideration he hesitates between De Groot's system where diphthongs form a separate class (also accepted by Trubetzkoy, 1939: 177-8), and his own, where the diphthongs are included among the 'schwachgeschnitten' vowels. According to Van Wijk, the fact that the diphthongs pattern with the 'schwachgeschnitten' vowels argues that they form one class. On the other hand, phonetically the two are completely different. Thus, he is not able to find a compelling argument for either (18)-(19) or (18b)-(20), although for the latter he would now actually prefer (22).

(22)

	aa	
ou	*ui*	*ei*
oo	*eu*	*ee*
oe	*uu*	*ie*

With reference to Van Wijk (1939), an argument in favour of (22) plus

(18b) rather than De Groot's system is put forward by Paardekooper (1948). He observes that in a lot of cases the diphthongs *ei, ui, ou* alternate with 'long' vowels, which would indicate that they belong the same system. Examples he gives are:

(23)

slijten	'to wear'	-*sleten*	(past pl.)
bijten	'to bite'	-*een beet*	'a bite'
sluiten	'to close'	-*sloten*	(past pl.)
buigen	'to bow'	-*een boog*	'a bow'
		-*beugel*	'brace'
houwen	'to hew'	-*hieuwen*	(past pl.)

The two post-war handbooks on the phonetics and structural phonology of Dutch mentioned above, Van den Berg (1959) and Cohen et al. (1959), differ as to their interpretations of the diphthongs *ei, ui, ou*. Cohen et al. observe that these diphthongs could be described either as monophonematic, or as biphonematic /*ɛi*/, /*ʌü*/, and /*ɔu*/, where all components occur independently in, for instance, /*bɛl*/ *bel* 'bell', /*bʌl*/ *bul* 'diploma', /*bɔl*/ *bol* 'ball', /*tin*/ *tien* 'ten', /*füt*/ *fuut* 'grebe', and /*mus*/ *moes* 'mash'. The authors argue that in such apparently balanced cases one chooses the phonologically simpler solution over the more complex one, which criterion here selects the latter option: the monophonematic interpretation requires one additional phonological opposition of monophthong vs. diphthong, and has to allow three more phonemes. This argument is slightly modified in the 1961 edition of the *Fonologie*, where it is pointed out that the phonetic realizations of the biphonematic diphthongs contain in their first halves combinatory variants [*ä, œ, å*] of the vowels of *pet, put, pot* which are [*ɛ, ʌ, ɔ*]. Furthermore, they drop the simplicity argument in favour of the biphonematic interpretation, replacing it by three new observations. Firstly, they argue that if a sound has phonetically two clearly distinguishable parts, then *ceteris paribus* one chooses a biphonematic interpretation for that sound. Secondly, they claim that a monophonematic interpretation would imply that /*ɛi*/ etc. are non-existent in Dutch, 'which blatantly contradicts the facts because every Dutchman hears *pij* when *ɛi* is uttered after *p*'[6] (28). Finally, although they are not overly convinced by this argument, the authors claim that the separate parts of the diphthongs may be interchanged with independent phonemes, as in /*kɛik*/ *kijk* 'look' vs. /*klik*/ *kliek* 'clique' vs. /*kɛlk*/ *kelk* 'calice', which would again argue for the biphonematic interpretation.

In his 1962 *Inleiding tot de Algemene Taalwetenschap* (p. 164), De Groot accepts the arguments of the *Fonologie* towards a biphonematic

interpretation of the Dutch diphthongs, although he does not consider the case ‘proven’. In the first 1959 edition of the *Foniek* Van den Berg conforms completely to the pre-war monophonematic interpretation of *ei, ui, ou*, while in later editions, especially when the author attempts to apply the principles of generative phonology to Dutch, the phonological interpretation of diphthongs has disappeared completely (cf. edition 6, 1972: 50).

After 1960 the question of the number of phonemes contained in the Dutch diphthongs is dealt with in Morciniec (1968), and Cohen (1971). Furthermore, the question of the place of the diphthongs within the entire vocalic system is taken up in Moulton (1962), and Damsteegt (1968). In the final part of this section we will deal with these papers in their chronological order.

Moulton (1962) presents an intriguing analysis of the vocalic system of Dutch from the point of view of structural phonology. He firstly does not accept any of the earlier divisions between the sets of vowels in (18a) vs. (18b). Thus, De Groot's proposal that the distinction is one between the ‘acoustic’ notions ‘clear’ vs. ‘dull’ ‘merely tells us that the two classes exist (a fact which we all intuitively accept), and then it attaches labels to them’ (299). On Van Wijk's proposal that the distinction is one between ‘schwachgeschnitten’ vs. ‘scharfgeschnitten’, Moulton accepts Van Haeringen's (1958) argument that ‘there is no way of determining that the syllable boundary which follows the [schwachgeschnitten] vowels … is in any way different from that which follows the [scharfgeschnitten] vowels …’ (300). Finally, Cohen et al.'s distinction between ‘tense’ vs. ‘lax’ resembles De Groot's in that ‘it is acceptable only after we have already separated these vowels into two different classes. That is to say, it does not tell us why we intuitively set up these two classes in the first place’ (300-1). Concluding that the attempts at making phonetic distinctions between the two sets of vowels have failed, Moulton goes on to present five *structural* arguments. They run as follows:

(i) (18a) occur in final position, not so (18b) (except for some interjections):

zie	‘see’	*moe*	‘tired’
zee	‘sea’	*zo*	‘such’
nu	‘now’	*la*	‘drawer’
reu	‘male dog’		

(ii) (18a) occur before /*j*/ and /*w*/, not so (18b), cf. (2);
(iii) (18a) do not occur before (most) final consonant clusters, as opposed to (18b):

nimf	‘nymph’	*korf*	‘basket’
terp	‘terp’	*hals*	‘neck’

(iv) as in (iii), for medial clusters, cf.

nimfen	*korven*
terpen	*halzen*

(plurals of the forms in (iii));
(v) (18a) followed by a sonorant take the diminutive suffix *-je*, preceded by a voiceless plosive homorganic to the final sonorant:

kiel	‘keel’	*kieltje*
zeem	‘chamois’	*zeempje*
baan	‘job’	*baantje*

(18b) followed by a sonorant take *-etje*:

zin	‘sentence’	*zinnetje*
kar	‘cart’	*karretje*
bal	‘ball’	*balletje*

Moulton goes on to observe that in all five cases the diphthongs *ei, ui, ou* pattern with the (18a) vowels, cf.:

(i) cf.(2);
(ii) forms in (i) followed by *-ə*, such as plural *keien* [*kɛijə*], and so on;
(iii) no diphthongs before final clusters;
(iv) no diphthongs before medial clusters;
(v) diminutives such as:

Paul	‘Paul’	*Paultje*
rijm	‘jingle’	*rijmpje*
tuin	‘garden’	*tuintje*

The structural difference between diphthongs and (18a) vowels lies in the fact that the latter may occur before *r*, but not so the former, cf.:

bier	‘beer’	*boer*	‘farmer’
beer	‘bear’	*boor*	‘drill’
buur	‘neighbor’	*daar*	‘there’
deur	‘door’		

However, there are also some phenomena to show that *ie, uu, oe* out of (18a) do not consistently pattern as (18a) vowels. Thus, (iii) and (iv) are violated by some past tense forms such as:[7]

wierp-wierpen	of	*werpen*	‘to throw’
wierf-wierven		*werven*	‘to recruit’
stierf-stierven		*sterven*	‘to die’
zwierf-zwierven		*zwerven*	‘to wander’
bedierf-bedierven		*bederven*	‘to spoil’
hielp-hielpen		*helpen*	‘to help’

Furthermore, (v) is violated by diminutives such as *bloemetje* ‘little flower’, and *wieletje* ‘little wheel’. These facts taken together lead Moulton to assume that *ie, uu*, and *oe* in some sense belong to both systems at the same time, and in order to express this he constructs the system in (24), capturing all vowels in one sweep.

(24)

	Front spread	Front rounded	Back rounded	
High	$\breve{i}$	$\breve{y}$	$\breve{u}$	short~long~diphthongal
Higher-mid	$\breve{e}, \bar{e}$	$\breve{\phi}, \bar{\phi}$	$\breve{o}, \bar{o}$	short≠long~diphthongal
Lower-mid	$\breve{\varepsilon}, \bar{\varepsilon}, \varepsilon i$	$-, \bar{\text{œ}}, \text{œ}y$	$\breve{\text{ɔ}}, \bar{\text{ɔ}}, \text{ɔ}u$	short≠long≠diphthongal
Low		$\breve{a}, \bar{a}$		short≠long

(Moulton, 1962: 310). Moulton comments that this ‘arrangement indicates the fact that *ie, uu, oe* show short, long, and diphthongal allophones, in non-contrastive distribution; and that *ee, eu, oo* show monophthongal and diphthongal allophones, also in non-contrastive distribution’. Notice that *ɛ̄, œ̄*, and *ɔ̄* occur only in French loanwords.

Damsteegt (1968) discusses two arguments for putting diphthongs and (18a) vowels together in the same structural class, both advanced in the third edition of Van den Berg's *Foniek*. In the first argument it is claimed that both belong together because both are diphthongic. Apparent ignorance of the IPO and Amsterdam investigations leads Damsteegt to conclude that insufficient clarity of the phonetic facts hamper a proper evaluation of this argument. Secondly, it is claimed that both belong together because neither occurs before *r*. However, as Damsteegt points out, this argument hinges on the premise that the vowels of *eer* ‘honour’, *deur* ‘door’, *oor* ‘ear’, and so on, cannot be equated with those of *leed* ‘grief’, *leut* ‘fun’, and *koot* ‘knuckle-bone’. While this may be true phonetically, according to

Damsteegt Van den Berg overlooks the fact that this is not necessarily so phonologically, since the vowels before *r* may well be allophonic variants of vowels in other positions. Although he does not mention Moulton's study, Damsteegt thus concludes in the same vein that there is at least one structural difference between diphthongs and (18a) vowels: they pattern differently before *r*.

Morciniec (1968), in a discussion of the arguments advanced for the biphonematic interpretation of Dutch diphthongs in Cohen et al.'s *Fonologie*, attaches little importance to the simplicity argument of the first edition, but puts forward as the first and foremost argument the replacibility of the respective components of the diphthongs. Thus, the second half of *bijt* 'bite' [*bɛit*] and *buik* 'belly' [*bœyk*] are replacible by the phoneme */* in *belt* 'tolls' [*bɛlt*] and *bulk* 'bellow' [*bœlk*], while the second halves of *hout* 'wood' [*hɔut*] is replaced by *n* in *hond* 'dog' [*hɔnt*]. Consequently, diphthongs should be treated as biphonematic phonologically. While this supports the analysis of the *Fonologie*, Cohen (1971) in fact withdraws the analysis of the latter. Thus, he admits that

(25)

> The fact that [the diphthongs] could be characterized by setting up two steady state vocoid segments was at one time regarded, as I now believe erroneously, as a fair indication of a biphonematic interpretation (Cohen et al. 1961). (282-3)

Cohen then goes on to reject both the biphonematic and the monophonematic interpretations, arguing that the latter unjustifiably puts out the diphthongs together with the 'long' vowels, while the former is

(26)

> equally unsatisfactory since: (a) it does not seem 'natural' to naive native speakers, (b) it introduces a class feature distinction [vocalic vs. non-vocalic] which cannot be supported by phonetic evidence, (c) It does not explain why e.g. in errors of speech two segments together are always involved, whereas in the case of other closeknit units, such as consonant clusters, individual members of these groups are found to play a part. (288).

Cohen then goes on the suggest that the 'way out seems to be to suggest to account by way of a special feature for the idiosyncratic phenomenon of diphthongs of the type described' (288). It may be worth observing that this proposal has a lot in common with Moulton's analysis. We will have occasion to return to it below.

4. Generative phonology

As pointed out in the introduction to this paper, the phonological component of a generative grammar must be viewed as a set of (partially) ordered phonological rules, connecting the underlying representations to the surface phonetic representations. Given the fact that the depth of this component is constrained by Postal's Naturalness Condition, one could claim in general terms on the subject of the Dutch diphthongs that they will be diphthongs, unless there is some reason to deviate from their phonetic characteristics, a reason expressible in terms of a generalization about the phonology of Dutch. Put slightly differently, the generative framework allows one to regard the phonetic diphthongs (and in fact any phonetic entity) as something, say Q, which deviates from the phonetic representation, as long as the phonology contains a schematic rule or rules of the form

(27)
Q → phonetic diphthong

where 'phonetic diphthong' is the phonetic representation of the Dutch diphthongs as described in section 2, and where Q is something different (present either at the underlying level, or derived as output of one or more previous rules), and motivated by generalizations about the phonology of Dutch. Below, we will first provide a brief survey of previous proposals on the Dutch diphthongs within the framework of generative phonology. In particular we will survey the various interpretations of 'Q' in these works. Secondly, we will provide an interpretation of our own, based primarily on the so-called 'intervocalic d' phenomena of Modern Western Dutch. Finally, we will point out some consequences of our approach for other areas of Dutch phonology.

Several attempts have been made in the recent past to represent the diphthongs of Dutch within a generative phonological framework at a more abstract level as something other than diphthongs, the argument in the earlier works being that this leads to a more acceptable inventory of underlying segments. The earliest generative description of the vocalic system of Dutch, De Rijk (1967), is characterized by an attempt to reduce all diphthongs to monophthongs at the underlying level. Making use of Cohen's feature [tense] for the distinction between (18a) and (18b) De Rijk claims that the diphthongs of the *ieuw*-class, which with a handful of exceptions[8] always occur in morpheme-final position, lack their second halves at the underlying level, which makes them morpheme-final tense vowels. The second halves are then provided by a phonological rule which

adds a [-voc, -cons] segment disharmonic to these vowels in morpheme-final position. In their turn, Cohen's surface morpheme-final 'tense' vowels (*zie, zee*, etc. above) escape the rule by being underlyingly 'lax' (i.e. [-tense]). They undergo a morpheme-final tensing rule, ordered after the 'glide' insertion rule. Here the procedure stops since there are no surface morpheme-final 'lax' vowels to be exempted from the tensing rule.[9]

Secondly, De Rijk attempts to characterize diphthongs of the *ei*-class as underlyingly 'high tense' vowels in all positions. Their phonetic manifestations are then derived by two rules: (i) a rule adding a [-voc, -cons] 'glide' segment; and (ii) a rule lowering the first halves of the resulting combinations. However, this time De Rijk is not able to find a suitable underlying representation for the surface 'high tense' vowels, and eventually he concludes that the *ei*-diphthongs had better be characterized as combinations of vowel plus glide at the underlying level: *ey, üµ*, and *ow*.

Apparently agreeing with De Rijk's first analysis of the *ei*-diphthongs, Van Bakel (1976) finds an alternative representation for the surface 'high tense' vowels in making them 'high lax' vowels underlyingly: they will be tensed by a later rule. In his system (which allows four vowel heights motivated, according to Van Bakel, by analyses of Dutch dialects) the 'high lax' vowels of (18b) are 'high mid lax' vowels.

Brink (1970) represents the diphthongs *ei* and *ui* as underlying tense vowels of indifferent height, and in order to differentiate them from the surface tense vowels he introduces upon the former the feature [+diphthongal]. According to Brink the 'advantage in historical studies of having such a feature available is obvious' (10). Furthermore, in order to explain some distributional gaps, the diphthong *ou* is proposed to have three different underlying sources: *ol, al*, and *ööw*. Phonological rules will turn the latter into *ou*. Brink represents the *ieuw*-diphthongs as combinations of 'tense' vowels followed by disharmonic [-syll, -cons] 'glides' at the underlying level. De Rijk's rules of 'glide' insertion and 'final vowel tensing' are replaced with 'morpheme structure conditions' with essentially the same contents.

These three analyses, as briefly reviewed above, clearly employ *ad hoc* mechanisms of various types. Firstly, they all employ the feature [tense], the doubtful nature of which for Dutch was already underscored by Moulton (1962). Furthermore, all assume that the second halves of the Dutch diphthongs are [-voc, -cons] or [-syll, -cons], i.e. neither vowels nor consonants, which, in view of the phonetic descriptions of section 2, is an abstract representation that should be accompanied by at least some amount of motivation. But this motivation is lacking in all works. Finally,

Brink's claim that the new feature [diphthongal] is obviously useful in historical studies goes unsupported in his book, and the same holds for Van Bakel's preference for a four height vowel system over a simpler three height system.

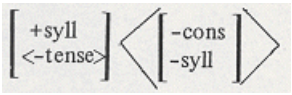
Another attempt at a characterization of the Dutch vocalic system is made in Smith (1973). He discusses the so-called 'intervocalic *d*' phenomena of Modern Western Dutch, some occurrences of which are displayed in (28).

(28)

/*reed-en*/	'drove'	>	[*re:jə*]
goed-e	'good, attr.'	>	[*ɣujə*]
rood-e	'red, attr.'	>	[*ro:jə*]
kwaad-e	'angry, attr.'	>	[*kwa:jə*]
glijd-en	'to slide'	>	[*ɣlɛijə*]
kruid-en	'herbs'	>	[*krʌyjə*]
oud-e	'old, attr.'	>	[*ɑuwə*]
snijd-en	'to cut'	>	[*snɛijə*]

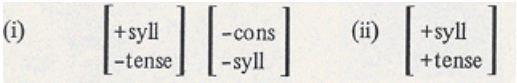
Since *d* never reduces after (18b) vowels (*radde* 'fast, attr.' > **rajə*; *redden* 'to save' > **rejə*; *padden* 'toads' > **pajə*), it is clear that the rule(s) required in a description of these phenomena should make a generalization over (18a) ('tense', 'long') vowels and diphthongs. Smith's first proposal is to use the representations of De Rijk (1967) (with 'syllabic' replacing 'vocalic') resulting in:

(29)



Given the appropriate abbreviatory conventions, (29) collapses (30i) and (30ii), in that order.

(30)



Smith, however, does not find this a completely satisfactory solution, and he goes on to make a second, tentative, proposal to the effect that 'tense' vowels may be represented as sequences of two 'lax' ones, at least for the purpose of the intervocalic *d* phenomena. This 'bimoric' representation is not at all unnatural, and has been proposed in the past for many languages with oppositions between vowels such as those in (18a) and (18b), both within structural and generative analyses. The resulting generalization over 'tense' vowels and diphthongs is that of (31).

(31)
[-cons] [-cons]

In Zonneveld (1978) the initial aspects of Smith's hypothesis are accepted, but it is developed differently. Firstly, it is argued that at the underlying level Dutch does not have segments which are [-syll, -cons] ‘glides’, but rather that Dutch underlying segments are either consonants or vowels, [+cons] or [-cons]. Thus, the final halves of the *ieuw*-diphthongs are consonantal underlyingly, which they remain when followed by a vowel, while they are turned into the sounds described in section 2 in final position. The absence of underlying glides also obviates the need for the feature ‘syllabic’ at this level. Since segments will be either consonantal or non-consonantal, this single binary feature will suffice for the classification of underlying Dutch segments. This is not to say, of course, that the feature ‘syllabic’ will not play a role at further phonological levels of Dutch phonology, but rather that its values will be predictable from the values of other features, either by language specific rules, or by universal conventions.

Secondly, a set of rules is proposed in Zonneveld (1978) for the intervocalic *d* phenomena in Dutch which differ rather drastically from those in Smith (1973). In two of these rules the generalization constituted by [-cons] [-cons] figures as follows:[10]

(32)
D WEAKENING

$$d \rightarrow \langle j \rangle \;/\; [-\text{cons}]_i \begin{bmatrix} -\text{cons} \\ \langle +\text{back} \rangle \end{bmatrix} \langle i \rangle \_\_ \# \; ə$$

HOMORGANIC GLIDE INSERTION

$$\phi \rightarrow \begin{bmatrix} +\text{son} \\ +\text{high} \\ \alpha\text{back} \end{bmatrix} \;/\; [-\text{cons}] \begin{bmatrix} -\text{cons} \\ -\text{low} \\ \alpha\text{back} \end{bmatrix} \_\_\_\_ (\#)\,[+\text{syll}]$$

Notice that the rule of D WEAKENING abbreviates two subrules, the first of which turns *d* into *j* after (18a) *back* vowels, and the second of which deletes *d* after the remaining (18a) vowels, and after diphthongs. In effect, the longer rule with angled brackets stands in a ‘special case’ relation to the shorter, ‘elsewhere’ deletion rule. The reason for this is outlined in Zonneveld (1978). Secondly, the rule of HOMORGANIC GLIDE INSERTION provides the appropriate ‘high sonorant’ segment (further details will be presently irrelevant) in those cases where *j* is not provided by the rule of D WEAKENING. Notice that HGI requires ‘full’ (syllabic)

vowels as its righthand environment. The usefulness of this feature in this case will be pointed out below. Some sample derivations employing the rules of (32) will run as in (33):

(33)

	reed-en	***goed-e***	***oud-e***
D WEAK	*Ø*	*j*	*Ø*
HGI	*j*	-	*w*

It is worth observing that the analysis of intervocalic *d* phenomena proposed here, in spite of the importance of an adequate representation of the Dutch vocalic system to them, does not require the objectionable feature [tense], the unmotivated feature [diphthong], abstract 'glides', or an unmotivated system of four vowel heights, like previous analyses of Dutch vowels. Rather, Dutch vowels are claimed to be [-cons], may be single or double, and the double ones may be identical or not.

It may be useful to pursue this analysis somewhat further, and see how it will account for the distributional facts surfaced in the structural analyses discussed in section 3. Firstly, the fact that only bisegmental vowels (including diphthongs) may occur in final position may be accounted for by a morpheme structure condition of the general type (34):

(34)
˜ × [+cons] [-cons] +

which denies the existence of monosegmental morpheme-final vowels. Similarly, constraints on the occurrence of vowels before clusters may be expressed in conditions of the general type (35):

(35)
˜ × [-cons] [-cons] C C Y

and so on.

The fact that monosegmental vowels do not occur before *j* or *w* is expressed in our framework in two different ways. When the combination is anorganic, it will be described by a morpheme structure condition à la Brink (with the proviso that for us *j* and *w* are consonantal, and 'tense' vowels are bisegmental). When the combination is homorganic, it will result from the application of the rule of HOMORGANIC GLIDE INSERTION in (32).

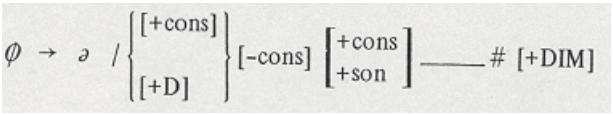
Furthermore, the phenomenon of the diminutive suffix depending on the phonological make-up of the preceding stem will be taken care of by a phonological rule of schwa-insertion of type (36):

(36)

$$\emptyset \rightarrow \text{ə} \;/\; [+\text{cons}]\ [-\text{cons}] \begin{bmatrix} +\text{cons} \\ +\text{son} \end{bmatrix} \_\_\_\_\ \#\ [+\text{DIM}]$$

In Zonneveld (1978) it is proposed that irregular forms such as *wiel+etje* may result from an irregular application of (36) to a schwa-less underlying form *wiel+tje*. In order to capture this, *wiel* will be lexically marked [+D], and (36) will be reformulated slightly into (37):

(37)



The alternations between 'bisigmental' vowels and diphthongs described by Paardekooper (cf. (23)) may be captured by rules of the general type (38):

(38)

$[\text{-cons}]_i\ [\text{-cons}]_i \sim [\text{-cons}]_i[\text{-cons}]_j$

where ~ indicates a lexical relation between different tenses of irregular verbs, and between verb and derived noun.

Finally, potentially most interesting is the difference in distribution between 'bisegmental' vowels and diphthongs before *r*, as discussed in section 3. As observed there, the former occur immediately before *r* (as do monosegmental vowels) while the latter do not. However, this observation appears to follow from the spelling system of Dutch rather than from phonetics since, as pointed out in section 2, in actual fact 'bisegmental' vowels are separated from *r* by a *ə*-like sound (or an *ɛ*-like sound for *a*). It may be worth pointing out that if this transitional sound is provided by a 'late', phonetic rule of Dutch, then there seems little reason not to seize the opportunity to capture with the same rule those cases where diphthongs are separated from *r* by a *ə*-sound (represented by *e* in writing) as in (39):

(39)

Beier-en	'Bavaria'	*luier*	'napkin'
meier	'bailiff'	*schuier*	'brush'
meier	'100 guilders'	*sluier*	'veil'
lauwer	'laurel'	*uier*	'udder'

This generalization of the rule is in fact supported by the alternation of *láuwer* with *laurír* '(something made of) laurel', which shows that schwa is inserted post-tonically before final *r*. That schwa is not deleted pretonically is shown by the form *verbouweréerd* 'flabbergasted', which retains pretonic schwa. Furthermore, that schwa is inserted before only *final r* is shown by the existence of forms such as *wíerp* and *zwíerf* mentioned earlier, which go without schwa, and by schwa-less pretonic diphthongs, such as in the words of (40):

(40)

auróra	'id.'	[*ɑur*-]	*heurístisch*	'heuristic'	[*hʌyr*-]
aureóol	'halo'	[*ɑur*-]	*Európa*	'Europe'	[*ʌyr*-]
Peyrác	'id.'	[*pɛir*-]			

Thus, a framework seems feasible where underlyingly *r* is preceded by all types of vowels, while *ə* is inserted after 'bisegmental' vowels and diphthongs by a rule such as (41):

(41)
Ø → *ə* / [-cons] [-cons] _ *r* #

Similarly, it may also be feasible to avoid specifying past tenses such as *wierp* and *zwierf* as exceptions to the constraint against (18a) vowels before clusters at the underlying level. Specifically, it appears to be the case that the vowel [*I*] does not occur at all before a liquid followed by a labial obstruent (except in the onomatopoeic word *tsjilpen* 'to chirp'). Thus, the past tense of verbs such as *werpen* and *zwerven* may differ from the present tense in height, and may be doubled by a phonological rule such as (42):

(42)

$$\begin{bmatrix}-\text{cons}\\-\text{back}\\-\text{round}\\+\text{high}\end{bmatrix}_1 \begin{bmatrix}+\text{son}\\-\text{nas}\end{bmatrix}_2 \begin{bmatrix}+\text{cons}\\+\text{ant}\\-\text{cor}\end{bmatrix}_3 \rightarrow 1\,1\,2\,3$$

Finally, rule (41) will have to be adjusted slightly for two reasons. Firstly, as pointed out earlier, it will have to insert *ɛ* rather than *ə* for the combination *aar*, but we will not go into that specific phenomenon here. Secondly, however, (41) should account for the fact that its schwa is a syllabic nucleus after diphthongs, but not so after 'bisegmental' vowels. Thus, words such as those in (39) contain a homorganic glide in between diphthong and schwa ([*mɛijər*], and so on), while *bier* and so on are monosyllabic, without a homorganic glide. This is effectuated by a slight reformulation of (41) into (43):

(43)

$$\emptyset \rightarrow \begin{bmatrix}\partial\\-\text{cons}\\<-\text{syll}>\end{bmatrix} / [-\text{cons}]_i\ [-\text{cons}]_{<i>} \_\_\ r\ \#$$

Thus, via (43) the fact is captured that the transitional sound will be non-syllabic after bisegmental vowels. After diphthongs, schwa will be non-consonantal, where the feature [+syll] will be supplied either by another language-specific rule, or by a universal convention, [+syll] being the natural state for a non-consonantal segment. Given this procedure, the rule

of HOMORGANIC GLIDE INSERTION in (32) will provide the required glide in forms such as *meier*, i.e. before a syllabic segment.

Given the above generative phonological account of the vocalic systern of Dutch, the set of rules involved in the system will have to be supplemented with two final rules. Firstly, the vowels represented as bisegmental will have to be 'contracted' or 'degeminated' by a phonetic rule of type (44), where the same rule may be employed to specify, for instance, degree of centralization, of specific height, and of lenght of these vowels under various environmental conditions.

(44)
$[\text{-cons}]_i\ [\text{-cons}]_i \rightarrow [\text{-cons}]_i$
with centralization *p* in env. *x*
height *q* in env. *y*
lenght *r* in env. *z*
and so on.

Finally, the last rule to be posited will be our original rule (27), where we are now in the position to specify Q more precisely as $[\text{-cons}]_i\ [\text{-cons}]_j$.

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Eindnoten:

1 *ei* has a spelling variant *ij*, and *ou* has the spelling variants *ouw, au*, and *auw*. Historically these spellings correspond to different sounds, but this will not concern us here.
2 In fact, Zwaardemaker and Eijkman (1928) give the first half of *ui* as [œ-|], i.e. a slightly backed [œ]. On the other hand, Eijkman (1937) gives [œ-], i.e. a slightly more close variant. These diacritics will not be gotten further into here.
3 As early as 1870, however, both Donders and Land made a difference for *ui* between open and closed syllables. Thus, the former gives $a^{\ddot{O}}u$ for *huis* 'house', and $a^{\ddot{O}}i$ for *lui* 'lazy' where $a^{\ddot{O}}$ is the

vowel of French *freule* 'lady', and *soeur* 'sister'. The latter gives $\ddot{o}^1$ *ü* and $\ddot{o}^1$ *i*, respectively, where $\ddot{o}^1$ equals Donders' $a^{\ddot{O}}$. Boer (1892) goes so far as to suggest that in closed syllables *ei, ui*, and *ou* are completely monophtongic, although perhaps 'physiologically more complex' than other monophthongs.

4 Translation from Zonneveld (1978: 70).
5 Translation by WZ/MT.
6 id.
7 For further discussion of these data see also Michels (1957).
8 Among the exceptions are, for instance, *Biscaye* 'Biscay', *dooier* 'yolk', *gevooisd* '-voiced', *kaaiman* 'cayman', *ooievaar* 'stork', *pooier* 'pimp', *Troye* 'Troy', and *turkoois* 'turquoise'.
9 Somehow the following loanwords have until now escaped attention as exceptions to this constraint: in [-*wɑ*] *Artois* 'id.', *Francois* 'Francis', and *schwa* 'id.'; in [-*ɛ*] *Calais* 'id.', *chalet* 'id.', *Jahweh* 'Jehovah', *parfait* 'id.', and *relais* 'relay'.
10 For expository purposes these rules are slightly adjusted vis-à-vis those presented in Zonneveld (1978).